GC28-0607-2
File No. S370-34

Systems

Introduction to JES3

JES3 Release 3

IBM

Page of GC28-0607-2
Revised February 15, 1979
By TNL GN25-0171

Third Edition (April 1978)

This edition, as amended by technical newsletters GN25-0167 and GN25-0171, applies to GC28-0607-2. This edition applies to JES3 Release 3 (Selectable Unit ID5752-826) of Job Entry Subsystem 3 and to all subsequent releases and modifications until otherwise indicated in new editions or technical newsletters.

JES Release 3 runs under OS/VS2 MVS. JES3 Release 3 must be applied to an OS/VS2 MVS Release 3.7 which has OS/VS2 Scheduler/IOS Support (Selectable Unit ID 5752-816) and OS/VS2 MVS Dumping Improvements (Selectable Unit ID 5752-833), or any subsequent functionally equivalent release of MVS. For details concerning prerequisites and corequisites, see *OS/VS2 MVS JES3 Release 3 System Information*, GC23-0024.

Changes are continually made to the information herein; before using this publication in connection with the operation of IBM systems, consult the latest *IBM System/370 Bibliography*, GC20-0001 for the editions that are applicable and current.

Publications are not stocked at the address given below, requests for copies of IBM publications should be made to your IBM representative or to the IBM branch office serving your locality.

A form for reader's comments is provided at the back of this publication. If the form has been removed, comments may be addressed to IBM Corporation, Department D58, Building 706-2, PO Box 390, Poughkeepsie, New York 12602. Comments become the property of IBM.

© Copyright International Business Machines Corporation 1975, 1977, 1978

Technical Newsletter

This Newsletter No. GN25-0171
Date February 15, 1979

Base Publication No. GC28-0607-2
File No. S370-34

Prerequisite Newsletters GN25-0167

Introduction to JES3

© Copyright IBM Corp. 1975, 1977, 1978

This technical newsletter provides replacement pages for *Introduction to JES3* to support JES3 Release 3 (selectable unit ID 5752-826).

Before inserting any of the attached pages into the base publication, read *carefully* the instructions on this cover. They indicate when and how you should insert these pages. Pages to be inserted/removed* are:

Pages to Be Removed	Attached Pages* to Be Inserted
Cover, Edition Notice	Cover, Edition Notice
3-3, 3-4	3-3, 3-4
5-1, 5-2	5-1, 5-2

*If you are inserting pages from different newsletters/supplements and *identical* page numbers are involved, always use the page with the latest date (shown at the top of the page). The page with the latest date contains the most complete information.

A change to the text or to an illustration is indicated by a vertical line to the left of the change.

Summary of Amendments

Changes reflect JES3 support of the Hierarchical Storage Manager (HSM).

Note: *Please file this cover letter at the back of the base publication to provide a record of changes.*

IBM Corporation, Publications Development, Department D58, Building 706-2, P. O. Box 390, Poughkeepsie, New York 12602

Printed in U.S.A.

IBM/Technical Newsletter

This Newsletter No. GN25-0167
Date September 30, 1978

Base Publication No. GC28-0607-2
File No. S370-34

Prerequisite Newsletters None

Introduction to JES3

©Copyright IBM Corp. 1975, 1977, 1978

This technical newsletter provides replacement pages for *Introduction to JES3* to support JES3 Release 3 (selectable unit ID 5752-826).

Before inserting any of the attached pages into the base publication, read *carefully* the instructions on this cover. They indicate when and how you should insert these pages. Pages to be inserted/removed* are:

Pages to Be Removed	Attached Pages* to Be Inserted
Cover, Edition Notice	Cover, Edition Notice
iii - vi	iii - vi
3-5 - 3-8	3-5 - 3-8
3-15, 3-16	3-15, 3-16
4-1, 4-2	4-1, 4-2
4-9, 4-10	4-9, 4-10
7-1, 7-2	7-1, 7-2
8-1 - 8-6	8-1 - 8-6
8-11, 8-12	8-11, 8-12
I-1, I-2	I-1, I-2

*If you are inserting pages from different newsletters/supplements and *identical* page numbers are involved, always use the page with the latest date (shown at the top of the page). The page with the latest data contains the most complete information.

A change to the text or to an illustration is indicated by a vertical line to the left of the change.

Summary of Amendments

This update reflects miscellaneous technical corrections to the base publication. The major changes are:

Dynamic Allocation Fast Path

Provides improved performance in I/O processing of single-unit volumes and data sets on permanently resident or reserved DASD using the DYNAL function of JES3.

IBM 3036 Support

The IBM 3036 System Console is supported as a 3277 display station.

Note: *Please file this cover letter at the back of the base publication to provide a record of changes.*

IBM Corporation, Publications Development, Department D58, Building 706-2, P. O. Box 390, Poughkeepsie, New York 12602

©Copyright IBM Corp. 1978 Printed in U.S.A.

PREFACE

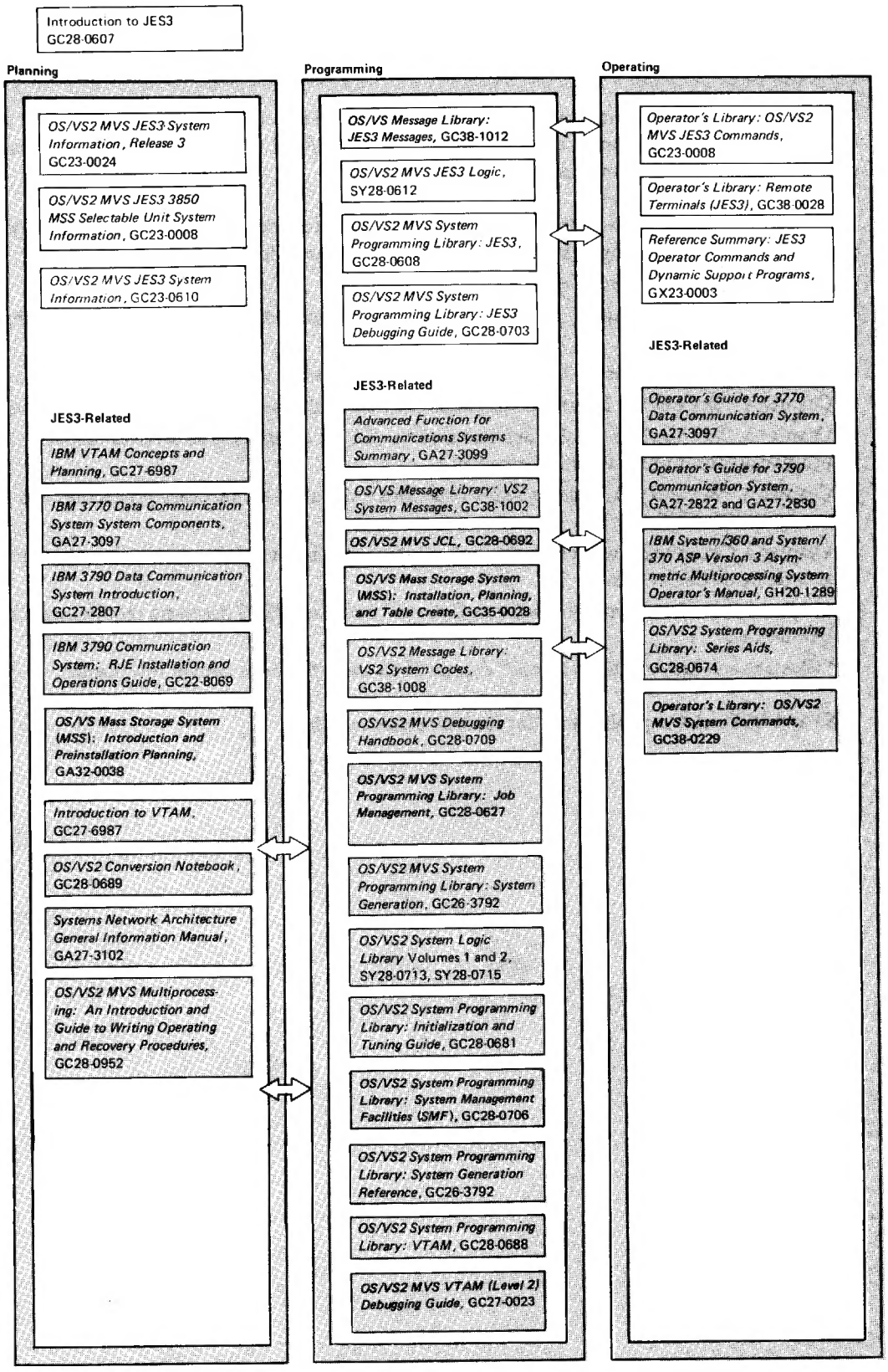
This publication contains introductory information about JES3, one of the primary job entry subsystems of OS/VS2. JES3 is a separately orderable component of OS/VS2. The reader should have a basic knowledge of programming systems, such as OS/MVT or OS/VS2.

Although this publication is designed to be read from cover to cover, the chapters are generally independent and can be referred to in any order. The chapters contain the following information:

- Chapter 1, "Introduction," presents highlights of JES3.
- Chapter 2, "JES3 Concepts", presents JES3 as a subsystem and explains how a job flows through the JES3 complex.
- Chapter 3, "JES3 Services", discusses the services provided by JES3 and how these services are used.
- Chapter 4, "Installation Interfaces with JES3 Services", discusses how the user utilizes JES3 services.
- Chapter 5, "MVS Job Processing Services used by JES3", discusses MVS services that JES3 utilizes in processing jobs through the JES3 complex.
- Chapter 6, "Recovery Procedures and Service Aids", discusses the recovery procedures and service aids provided with JES3.
- Chapter 7, "Planning Considerations", presents some preliminary information about planning and generating a JES3 system.
- Chapter 8, "JES3 System Configuration Options", lists basic JES3 hardware requirements and supported I/O devices.
- "Glossary and List of Abbreviations" defines JES3 and VS2 terms used in this manual.

JES3 and JES3-related publications for further reference follow:

JES3 RELATED PUBLICATIONS



SUMMARY OF AMENDMENTS
for GC28-0607-2
as updated by GN25-0167
JES3 Release 3

Dynamic Allocation Fast Path

Improved performance in I/O processing of single unit volumes and data sets on permanently resident or reserved DASD using the DYNAL function of JES3.

IBM 3036 Support

The IBM 3036 System Console is supported as a 3277 display station.

SUMMARY OF AMENDMENTS
for GC28-0607-2
JES Release 3

This release of JES3 includes the systems network architecture remote job processing (SNA RJP) facility which extends the remote job processing capabilities to include VTAM and SNA synchronous data link control (SDLC) communications. With the availability of SNA RJP, an MVS host with JES3 may send and receive jobs to and from both binary synchronous and SNA remote job entry stations.

Supported SNA RJP entry stations are LUTYPE1 devices such as:

- 3770 Data Communication System (SDLC models)
- 3790 Communication System (both local and remote attachment)

This publication has been reorganized and rewritten to increase its usability as an introduction to JES3. Information has also been added to provide planning information for users installing JES3 on a System/370 running under OS/VS2 Release 3.7.

SUMMARY OF AMENDMENTS
for GC28-0607-1
JES3 Release 2.1

IBM 3850 Mass Storage System Support (MSS)

The IBM 3850 MSS is supported by JES3.

IBM 3800 Printing Subsystem Support

The IBM 3800 Printing Subsystem is supported as a JES3 output device.

CONTENTS

	Page
Chapter 1. INTRODUCTION	1-1
JES3 CONCEPTS	1-1
JES3 System Configuration	1-1
Purpose of JES3	1-3
Benefits to the JES3 User	1-3
JES3 JOB PROCESSING FEATURES	1-4
Resource Scheduling and Management	1-4
Job Selection and Scheduling	1-5
Output Processing	1-5
OPERATIONAL ENVIRONMENT	1-6
JES3 SUPPORT FEATURES	1-6
JES3 RAS FEATURES	1-7
JES3 MIGRATION AID	1-9
Chapter 2. JES3 CONCEPTS	2-1
GENERAL CONCEPTS	2-1
JES3 STANDARD JOB FLOW	2-2
Chapter 3. JES3 SERVICES	3-1
JES3 SYSTEM INITIALIZATION	3-1
JES3 JOB MANAGEMENT	3-3
Input Service	3-3
Interpreter Service	3-3
Data Resource Management	3-5
Volume Fetching	3-5
Data Resource Allocation	3-6
Volume Mounting and Verification	3-7
Deallocation of Data Resources	3-7
Job Scheduling	3-8
Generalized Main Scheduling	3-8
Deadline Scheduling	3-9
Dependent Job Control	3-9
Job Execution	3-10
Spool Data Management	3-11
Job Output	3-11
Output Service Scheduling	3-12
Output Service Writers	3-12
External Writer Support	3-12
Internal Reader Support	3-12
Job Cleanup – PURGE	3-13
REMOTE JOB PROCESSING (RJP)	3-13
BSC RJP	3-13
BSC RJP Features	3-13

Page

SNA RJP 3-14
SNA RJP Features 3-15
BACKGROUND JOB FACILITIES FOR TSO USERS 3-16
CONSOLE SERVICES 3-16
Multiple Console Support 3-17
GENERAL ROUTINES 3-17
UTILITY DYNAMIC SUPPORT PROGRAMS 3-18
Card-to-Card DSP 3-18
Card-to-Printer DSP 3-18
Card-to-Tape DSP 3-18
Dump Job DSP 3-18
Tape Dump DSP 3-18
Tape Label DSP 3-19
Tape-to-Card DSP 3-19
Tape-to-Printer DSP 3-19
Tape-to-Tape DSP 3-19

Chapter 4. INSTALLATION INTERFACES WITH JES3 SERVICES 4-1
INITIALIZATION CONTROL 4-1
JES3 Procedure 4-2
Mass Storage System Table Build Program 4-2
Initialization Statements 4-2
OPERATOR INTERFACE 4-5
Operator Commands 4-6
JES3 JOB CONTROL LANGUAGE 4-6
JES3 JOB CONTROL STATEMENTS 4-7
USER EXITS 4-8
USER – WRITTEN DSPs 4-9
SYSTEM MANAGEMENT FACILITY (SMF) 4-9
EXTERNAL WRITER SUPPORT 4-9

Chapter 5. MVS JOB PROCESSING SERVICES USED BY JES3 5-1
SUPERVISOR SERVICES 5-1
CATALOG MANAGEMENT 5-2
I/O SUPERVISOR 5-2
SYSTEM RESOURCE MANAGER 5-3
VTAM INTERFACE 5-3

Chapter 6. JES3 RECOVERY PROCEDURES AND SERVICE AIDS 6-1
RECOVERY PROCEDURES 6-1
Alternate Processor (CPU) Recovery Support 6-1
Alternate Path CTC Support 6-1
Checkpoint Restart Support 6-1
RJP Recovery Capabilities 6-1
Hot Start Restart Support 6-2
Spool I/O Error Recovery 6-2

Page

Failsoft 6-2
Dynamic System Interchange 6-2
SERVICE AIDS 6-3
ASP-to-JES3 Migration Aid 6-3
ASP Main Simulator 6-3
Console Test 6-3
Control Block Print 6-3
Display Dependent Job Control Tables 6-4
Display JES3 Job Queue Status 6-4
Display Selected Areas of Storage 6-4
Event Trace Facility 6-4
Interpreter Debug Facility 6-4
JES3 Abend Dumps 6-4
JCL Test Facility 6-4
Job Setup Table Test 6-5
RJP Line Snap Facility 6-5
Storage Dump on Initialization Error 6-5
SNA RJP VTAM Debugging Aid 6-5
CTC CCW Trace Facility 6-5

Chapter 7. PLANNING CONSIDERATIONS 7-1
SYSTEM GENERATION 7-1
JES3 System Generation Macro Considerations 7-1
PHYSICAL PLANNING 7-2

Chapter 8. JES3 SYSTEM CONFIGURATION OPTIONS 8-1
MINIMUM CONFIGURATION 8-1
SPOOL CONFIGURATION 8-1
CONSOLE CONFIGURATION 8-2
I/O DEVICE CONFIGURATION 8-6
REMOTE DEVICE CONFIGURATION 8-6
BSC REMOTE WORK STATIONS WITH MULTI-LEAVING SUPPORT 8-6
BSC REMOTE WORK STATIONS WITHOUT MULTI-LEAVING SUPPORT 8-9
SNA REMOTE WORK STATIONS 8-9

Glossary of Terms and Abbreviations G-1

Index I-1

FIGURES

Figure 1-1. Basic JES3 Configuration 1-2
Figure 1-2. Basic JES3 Tightly Coupled and Loosely Coupled Configurations 1-8
Figure 2-1. JES3 Job Processing Overview 2-3
Figure 3-1. JES3 Job Processing Services 3-2
Figure 3-2. Simple Dependent Job Control Network 3-9
Figure 3-3. Complex Dependent Job Control Network 3-10
Figure 4-1. Installation Job Processing Services 4-1
Figure 4-2. JES3 Initialization Statements and Their Functions 4-3
Figure 5-1. MVS Job Processing Services Used by JES3 5-1
Figure 8-1. MCS Console Configuration Devices 8-2
Figure 8-2. JES3 Console Configuration Devices 8-3
Figure 8-3. I/O and Remote Configuration Devices 8-7
Figure 8-4. BSC Remote Work Stations with MULTI-LEAVING Support 8-8
Figure 8-5. BSC Remote Work Stations without MULTI-LEAVING Support 8-10
Figure 8-6. SNA RJP Work Stations 8-12

Chapter 1. INTRODUCTION

Job Entry Subsystem 3 (JES3) is an integrated component of OS/VS2 MVS that provides job-entry, scheduling, simultaneous peripheral operation on-line (SPOOL) services, and job output capability to operating systems.

JES3 CONCEPTS

The purpose of a job entry subsystem is to provide the vehicle through which input and output devices interface with system processing functions. A basic job entry subsystem:

- Gathers jobs and data from local or remote input devices
- Presents jobs to the system scheduler for execution
- Monitors the execution of jobs
- Gathers printed and punched data for later disposition
- Prints and punches the gathered output on local or remote devices.

In addition to providing these basic job entry functions, JES3 provides efficient distribution of batch work among several processors, loosely coupled by channel-to-channel adapters and sharing a SPOOL data set.

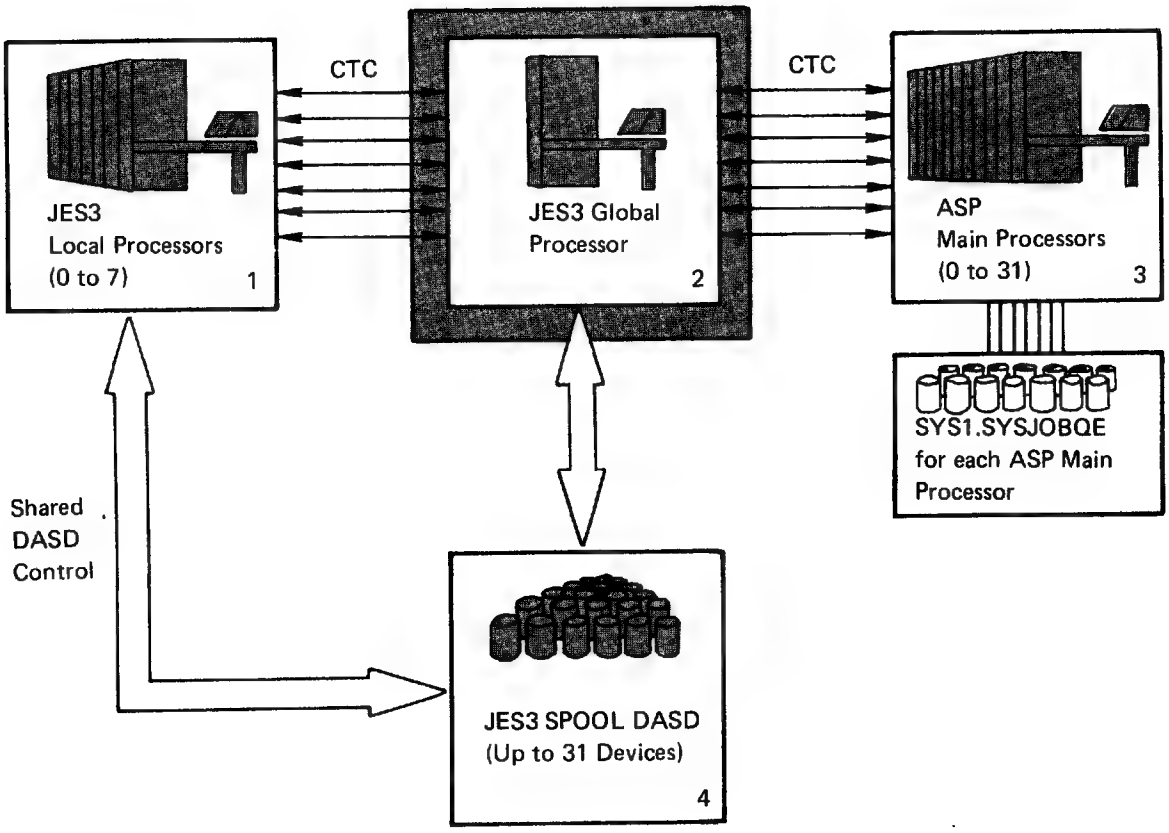
JES3 provides efficient distribution through:

- Advanced operations and scheduling features which can be specified during JES3 initialization as JES3 options to provide flexibility in job execution sequence, resource scheduling, and workload balancing.
- An implementation approach which allows the loosely coupled multiple processors to maintain a single image for operations, job scheduling, and resource management.

JES3 is the primary job entry subsystem in each MVS processor in the JES3 configuration. One processor, the *global* processor, provides the functions of job input/output, resource management, job scheduling, and operations interface to the system. Other processors, *local* processors, provide the communications interface to the global and process I/O requests to the shared JES3 SPOOL volumes from jobs in execution. In order to provide for orderly transition, JES3 also supports ASP main processors with the JES3 global processor acting in place of the ASP support processor. JES3 also provides for non-disruptive growth through the configuration flexibility afforded by loosely coupled multi-processing, allowing additional processors to be added as required.

JES3 System Configuration

Figure 1-1 illustrates a basic JES3 configuration. Configurations can range from a single uniprocessor up to a combined maximum of 32 processors—8 of which can be MVS/JES3 processors and the remainder ASP main processors running under either MVT or SVS. If a global processor fails, any properly configured MVS processor within the JES3 complex may assume the controlling role. This exchange of roles is called the dynamic system interchange facility (DSI). Through the single-system image concept, JES3 allows smaller incremental growth steps (i.e. adding a loosely coupled System/370 158 as an additional local processor) without disrupting the scheduling or operational environment within the computer room. For details on supported JES3 devices, refer to Chapter 8, "JES3 System Configuration Options".



1. Maximum of 7 local processors attached to global
2. Only 1 global processor per JES3 configuration
3. Up to 31 total processors (ASP main or local processors)
4. Up to 31 SPOOL DASDs

Figure 1-1. Basic JES3 Configuration

Purpose of JES3

JES3 increases total system batch throughput and enhances an installation management's control over how the system processes the installation's work. MVS places a heavy emphasis on interactive processing, but most installations will continue to have a significant batch load to support their data processing activities. To enhance throughput, JES3 scheduling is based on resource availability. Jobs are not selected for execution until all required resources are available. To enhance installation management control, JES3 provides a single system image for multiple, loosely coupled processors.

To help provide resource availability, JES3 has implemented total resource management. That is: CPU's, I/O devices, volumes, and data sets are managed by JES3. Centralized job scheduling, selection, and resource allocation are accomplished by one processor on behalf of the other processors in the system. The primary operations interface is provided on the global processor. In this way, JES3 can provide more efficient resource utilization and operational control for the entire system.

Benefits to the JES3 User

In a large system environment, the increase of randomly submitted work through remote job processing, time sharing, and batch created job streams has made the operations task of monitoring the work in the queue and adjusting system scheduling almost impossible due to the dynamics of what work may be in the queue at any one time.

JES3 provides workload balancing among the processors in the configuration based on resource requirements of jobs in the system queue. The way JES3 performs workload balancing is the same whether one or several processors make up the MVS/JES3 system configuration. Thus orderly, non-disruptive growth is possible by adding another loosely coupled processor to the configuration without creating a new operational and scheduling environment.

When called upon to schedule a job, JES3's centralized scheduler is aware of the workload on each processor and the resources available on each processor and therefore, can determine the best job to match the installation's objectives for workload balancing.

JES3 provides:

- Operations and scheduling functions to view several processors as though they were a single system.
- Resource management and centralized job scheduling functions to dynamically adjust to a changing load on the system.
- Flexible output processing to extend resource scheduling to meet the requirements of processing job output.
- Isolation of JES3 system failures from application programs and the Dynamic System Interchange facility to increase total system availability.

In summary, the ability to manage jobs entering a JES3 installation increases, resulting in better utilization of the data processing facility.

JES3 JOB PROCESSING FEATURES

JES3 job management is divided into two components: resource scheduling and management and job selection and processing. JES3 provides the following functions across a multiprocessor complex.

- Input of a job into the complex from any of several sources (external or internal).
- Control of job selection by any of several scheduling algorithms.
- Unit, volume, and data set management.
- Operator communication and control (including remote and TSO users).
- Passing spooled, in-stream data to a running program.
- Accepting and spooling SYSOUT data.
- Output of SYSOUT data to any of several destinations.
- Certain operator utility functions, including debugging aids.
- Collection of accounting information.
- Remote job processing (both BSC RJP and SNA RJP).
- User dynamic support programs (DSPs).

Although several functions are illustrated here, the JES3 services that provide these functions are discussed in detail in later chapters.

Resource Scheduling and Management

A frequent problem in multiple CPU installations is that a job may be scheduled to a processor and either not enough devices are available to satisfy the job's requirements or a particular volume required by the job may be in use on another processor. Centralized resource scheduling is the JES3 global function that maintains information about execution-time resources required by jobs and which processors have access to which devices. JES3 resource management ensures that a job's data resources are available prior to its selection for execution to avoid delays caused by volumes or devices not being available. JES3 also maintains awareness of the processing intent for data sets to ensure that two jobs updating the same data set are not simultaneously scheduled.

JES3 uses the job's JCL and installation-specified parameters to provide allocation control for mountable tapes and DASD, DASD data set processing intent checking, and serialization of use for unit record and graphics devices.

The main device scheduling portion of JES3 resource management provides the pre-execution allocation of JES3 managed resources, interfaces with MVS allocation during job execution, and maintains an operations interface to resource management.

There may be instances when a particular volume is unavailable for use for some period of time. Operator commands exist to inform JES3 main device scheduling functions that a volume is unavailable and to inform JES3 when it becomes available. Jobs requiring unavailable volumes are suspended until the operator informs the main device scheduler that the volume(s) are available. Then, JES3 resumes resource allocation processing for the suspended jobs.

The installation can specify, via JES3 initialization parameters, how the system is to manage a job's resource requirements versus the requirements of other jobs in the system. The depth of pre-execution resource allocation can be specified for each processor, for the total configuration, and by job class to match resource allocation to the job scheduling criteria. This prevents a low priority job class from pre-allocating a large number of resources.

Job Selection and Scheduling

Once a job's I/O resources are available and mounted, the job enters the selection phase. Jobs are selected for execution by the generalized main scheduling function of JES3. Job selection is based on installation-specified parameters that drive the selection algorithm. Each processor is assigned a selection mode which specifies how jobs are to be chosen from the available queue of work. The scheduling requirements of each job class in relation to other job classes are installation defined and specify the job's CPU to I/O ratio and allowable scheduling mix. The select mode specified for each processor determines which groups and classes are eligible for selection. When a job is at or above the main barrier priority, job selection is suspended for the processors on which the job is eligible to run until the job is selected.

Through the use of the generalized main scheduling initialization parameters and job related JES3 control cards supplied with jobs entered into the system, work can be directed to a specific processor or control program type. Inter-job dependencies and job scheduling deadlines can be specified. JES3 generalized main scheduling automatically monitors the availability of execution resources across all processors and schedules work to available resources.

Output Processing

JES3 provides a great deal of flexibility in the processing of output data sets. The output data sets of a job may be asynchronously processed based on their individual requirements.

JES3 provides two types of writers: hot and dynamic. Dynamic writers are system-started when an output device is available and there is work in the queue that can be processed on the device. When there is no more work in the queue, JES3 automatically terminates the dynamic writer. Hot writers are operator started and terminated. Hot writers use operator-specified data set selection parameters to process work from the queue on the device specified in the writer call. Hot writers remain active, waiting for data sets to enter the output queue matching their selection criteria, until the selection criteria are changed by the operator or until the writer is terminated by the operator. By using a combination of hot and dynamic writers, the installation can efficiently manage its output processing requirements.

Data set selection for processing by a writer is based on attributes of the data sets that may be set in several ways. These are: JES3 job control card //*FORMAT, MVS JCL specifications, or JES3 initialization definitions for the default attributes of each SYSOUT class. The attributes represent requirements for mountable device facilities such as forms and carriage, and data set attributes such as priority, line count, and output class.

JES3 output service provides an extensive command facility for operator inquiry and modification of the output data set queue. The writer *CALL, *START, and *RESTART commands are structured to allow the operator to specify the data set selection criteria and control the actual processing of output data sets.

The MVS external writer interface is supported by JES3 output service to allow the installation to provide their own external writer or use the IBM-supplied external writer.

Support for the MVS data set spinoff facility is provided by output service. This allows a SYSOUT data set to be processed independently of the job that created it.

OPERATIONAL ENVIRONMENT

System-wide functions for all processors are controlled from consoles attached to the global processor. The installation can allow system commands to be entered and system messages to be received at these JES3 consoles, reducing or eliminating the need to have an operator stationed at system consoles on each separate processor. The implementation of multiple JES3 operator consoles, the separation of JES3 global functions, and the two-way operator communication with JES3 support functions cause the loosely coupled complex to appear as a single system rather than one comprising several separate and independently operated computer systems.

JES3 provides an installation with flexibility in the location of machine room equipment. By using additional operator consoles, JES3 installations can physically separate the operational functions (card input/output, printing, and tape setup), locating them in areas more convenient to the local work flow. When necessary, messages can be sent between JES3 consoles. Card readers, card punches, and printers can be located in the job dispatching area where programs are submitted for execution and to where output is returned. The mountable input/output units can be placed in an area convenient to the tape and disk library. In addition, an operator console can be placed at the tape and disk librarian's desk to receive volume fetch requests. The central processing units can then be placed in some other area that is free of the congestion that often surrounds peripheral units.

JES3 SUPPORT FEATURES

JES3 offers additional support functions such as operator utilities, dynamic support programs, MVS dynamic device reconfiguration interface, and time sharing interface.

Operator utilities such as the card-to-printer and tape-to-printer dynamic support programs offer background utilities transparent to normal operations. In addition to these, JES3 is designed to allow the user to add dynamic support programs (DSPs) that may be used by the operator or by jobs submitted to JES3 to provide tailored functions that are not part of the JES3 distributed system. Adding them requires only an entry in a system table and no in-line modifications to the system to have them available. JES3 also provides user exits at strategic locations in the system (such as input service, JCL conversion, output service, console service, and system initialization) for the installation to further tailor existing system function to meet its needs.

JES3 interfaces with MVS dynamic device reconfiguration to maintain awareness of any device reconfiguration that may occur.

The installation can establish application-oriented procedure libraries and associate the use of the libraries with particular jobs in the system. Procedure library update control ensures that no job in the system can reference a particular procedure library (PROCLIB) until the update job has completed.

JES3 interfaces with MVS TSO to provide for job submission, job status or cancel requests from the TSO terminal, and output transmission to the TSO terminal. JES3 also provides a comparable interface to TSO on an attached ASP MVT or SVS main processor.

In addition to the job output data set SMF records, JES3 produces a number of other SMF records for installation accounting use. These include: subsystem start/stop, remote job processing terminal signon/signoff, setup device allocation/deallocation and operator mount time, output writer accounting, and the summary job purge record.

JES3 RAS FEATURES

System availability and recovery management is provided through a JES3 facility known as JESTAE which provides an extension of MVS recovery management for the functions within the JES3 address space. If a software failure occurs, JES3 failsoft is invoked to collect failure symptom information, logout the error, and invoke the functional area's JESTAE recovery routine. All critical JES3 system components are protected by at least one level of JESTAE recovery routine. If the functional area's JESTAE cannot recover from the failure, the next higher level of failure protection is invoked. This level is a JES3 recovery function designed to insulate the rest of JES3 from a component failure. The JESTAE attempts to return any resources in use by the function that are required for normal operation and prevents the component from being rescheduled and having the failure re-occur.

JES3 also provides several problem determination aids to assist in gathering information associated with the various JES3 components. These include: a teleprocessing tracing facility, a generalized JES3 event trace and display facility, a facility to set traps and to collect data from the JES3 address space, and formatting of the JES3 control blocks and tables from a system abend or standalone dump. These are discussed in "Chapter 6. JES3 Recovery Procedures and Service Aids."

In the event of a failure from which the JES3 address space is unable to recover, a form of system initialization called "hot start" has been provided to reinstate JES3. Jobs on the processor will continue execution during hot start processing. If a JES3 system service is required prior to JES3's being reinstated, the job(s) requiring the service will be placed in a wait state until JES3 initialization is complete. JES3 will then process the pending service requests and the jobs will continue normally.

Since the JES3 spool volume(s) are shared among all MVS/JES3 processors in the configuration, a failure on the global or local(s) will not affect the others. If the global system is the one that failed and if a JES3 global service is required prior to a hot start on the global, the requesting job(s) will wait until the global restarts and then continue normal execution when the service request has been satisfied. Reading and writing of data on spool is done independently by each of the JES3 processors. However, global service is required to allocate space on the spool for output data sets.

Shared JES3 spool and hot start make possible the JES3 facility known as dynamic system interchange (DSI). If a catastrophic failure occurs on the global processor, a capable JES3 local processor can be instructed to assume the global function. Figure 1-2 illustrates loosely and tightly coupled configurations using a shared spool and CTC connections for DSI. Operator commands and messages are provided to manage the switching of global devices such as consoles, unit record, and teleprocessing devices. When the operator indicates that all necessary devices have been switched to the new global processor, JES3 in the DSI processor reinitializes itself as a global processor reconnects to the local(s), and collects and processes any pending global service requests. Jobs in execution on the local(s) (including the one becoming global) are unaffected by the DSI process other than waiting for JES3 services.

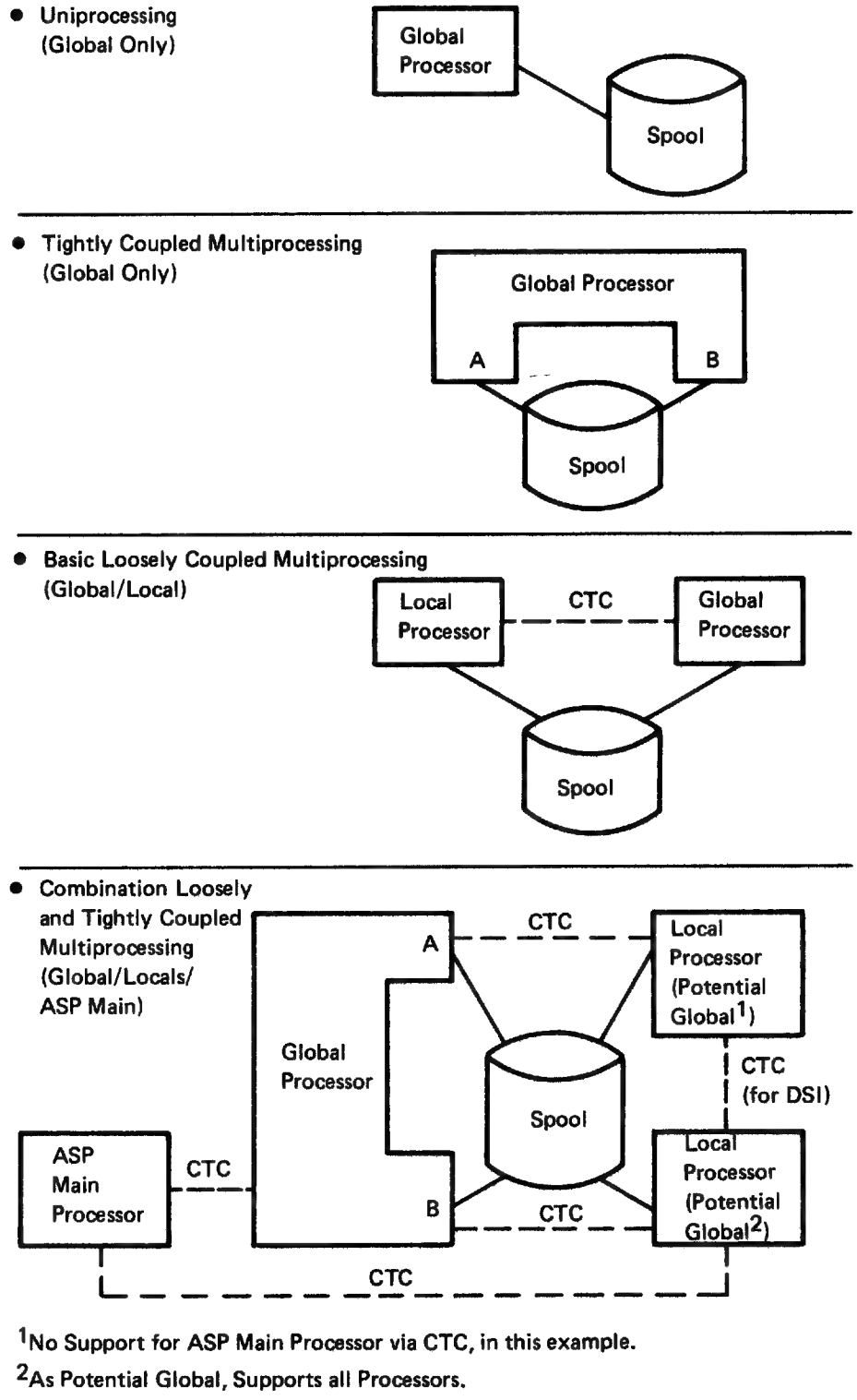


Figure 1-2. Basic JES3 Tightly Coupled and Loosely Coupled Configurations

The function of SPOOL I/O error recovery processing is to minimize the system impact of I/O errors. If the error occurred while processing an output data set, JES3 spool data management attempts to reconstruct the data record chain and to continue processing and lose as little of the output as possible. If the error occurred while writing a data record to disk, JES3 spool data management flags the track as bad and allocates a new track to write the data to.

JES3 interfaces with MVS checkpoint/restart and maintains a job journal on the JES3 SPOOL DASD. If a system failure requiring an IPL occurs during execution of a JES3 job, the JES3 automatic recovery function reads the JES3 job journal and determines job status at the time of failure and what action should be taken to continue job execution.

JES3 MIGRATION AID

The ASP/JES3 Migration Aid is the function that allows an ASP support processor to transmit jobs to and receive job output from a JES3 global processor. Based on selection criteria specified for the ASP side of the migration aid, jobs in the ASP queue are transmitted to the JES3 global processor. After the job is executed on MVS/JES3, its output is either returned to ASP, processed by JES3 output service, or undergoes a combination of both. The JES3 global can have unit record and RJP devices attached and be processing its own job input/output as well as accepting jobs across the migration aid. The intent of the migration aid is to provide a vehicle to assist in an orderly transition to MVS/JES3 by allowing parallel testing of jobs that are submitted from remote locations without disrupting the normal installation operating procedures. The migration aid is not intended as full production support of communicating global processors and support processors.

Chapter 2. JES3 CONCEPTS

This chapter provides a general overview of how a job flows through the JES3 system.

GENERAL CONCEPTS

Job submitted to JES3 are processed by the JES3 job services dynamic support programs (DSPs). DSPs are multiprogrammed components scheduled by JES3 within the JES3 memory. DSPs can be directly related to a job's execution (such as the reader/interpreter DSP) or they can be background utilities (such as the card-to-tape DSP).

Jobs submitted to JES3 are processed by the JES3 input service DSP, which reads the job and builds the required JES3 control blocks. Once this is completed, the following JES3 DSPs service a standard job through the JES3 complex:

1. The *MVS converter/interpreter (CI DSP)* processes JCL and determines the JES3 resources needed by the job.
2. The *main device scheduler (SETUP DSP)* sets up required devices, volumes, and data sets before job execution.
3. The *main service (MAIN DSP)* function selects the jobs for execution, and monitors the job while it is in execution.
4. The *output service (OUTSERV DSP)* function selects the output characteristics for the actual writing function and schedules the job output.
5. The *purge (PURGE DSP)* function releases all JES3 resources used during the job.

Nonstandard DSP processing for a job is specified by including //*PROCESS control statements in the job's job control language (JCL). Some jobs require special services from the global JES3 processor before or after their execution. Other jobs do not require all of the standard job processing services (such as device setup, or job execution for a test job). To use any nonstandard job processing service, insert into the job stream a series of //*PROCESS control statements that explicitly state all the job services required.

The system programmer can define, write, and install DSPs to perform any special job services needed but not supplied by JES3.

DSPs are controlled within JES3 by a priority-dispatching function (called the multifunction monitor). Any function that is implemented as a DSP is subject to this control. A user-written DSP can access all the JES3 control tables and use the JES3 programming tools (e.g., JES3 macros and JES3 spool data management). For further information on DSPs and user exits, refer to the *OS/VS2 MVS System Programming Library: JES3.*

JES3 STANDARD JOB FLOW

All jobs are initially read by JES3 into the global processor and are assigned a unique JES3 job number. Jobs can be submitted through tape, disk, or local or remote card readers attached to the global processor. In addition, jobs can be submitted to the global processor from TSO terminals, and the internal reader. The standard job processing flow, illustrated in Figure 2-1, is as follows.

1. The job is read into the system and placed in the JES3 job queue by the support function called input service.
2. Immediately after input service, interpreter service is eligible to perform its functions in two phases. During the first phase of JCL conversion and interpretation, syntactical and logical errors in the job's JCL are detected. This early JCL analysis allows cancelation and printing of a job with JCL errors. During the second phase, the job's system control blocks are scanned, and its resource requirements are determined. As in the first phase, a job with errors is scheduled for output processing, bypassing execution.
3. A job without JCL or control block errors is passed to the main device scheduling function for preexecution setup. Based on the requirements of the job, volumes that require mounting are requested from the tape and DASD library. Devices are then allocated for volumes that require mounting, and the applicable mount messages are sent to the appropriate device operator.
4. MVS initiators use the subsystem interface (SSI) routine called "job select" to request jobs from JES3. (SSI routines allow direct communication between the global JES3 address space and other address spaces, as shown in Figure 2-1.) Based on device requirements, initialization specifications, job definition, and user exit authorization, an eligible job is scheduled for execution on either the global processor or a local processor. Jobs scheduled to execute on an ASP main processor are passed directly to the processor as they become eligible. After execution is complete, resources are deallocated, and control is passed to the JES3 global processor for output processing.
5. Normally, output data sets are printed or punched by the JES3 output service function. Output service informs the operator of any setup requirements, such as forms, character set, or carriage control. The devices used can be local or remote, as defined for the job. JES3 SSI routines allow access to output data sets created during job execution. Such output is available for use by an external writer or in response to a TSO OUTPUT command.
6. The purge support function releases for use by other jobs all JES3 queue space and remaining devices associated with the completed job and writes an SMF record for the job.

In most cases, the standard job sequence described above will meet the needs of the application programmer; however, through the inclusion of JES3 control statements in the job's JCL, the job function sequence can be altered for special JES3 processing. Jobs that contain these special JES3 control statements in the job stream are termed nonstandard jobs.

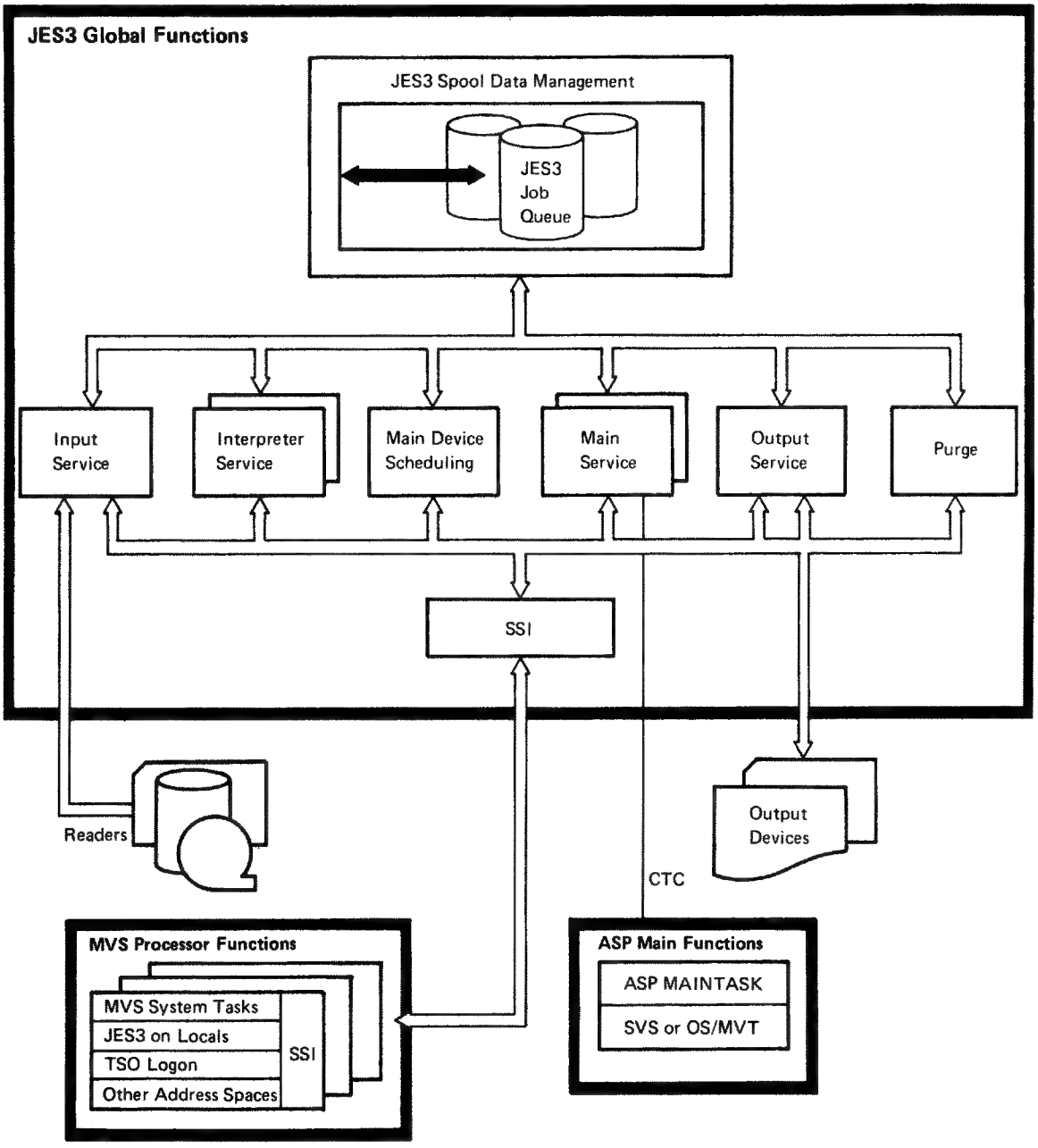


Figure 2-1. JES3 Job Processing Overview

Chapter 3. JES3 SERVICES

This chapter provides a general description of the functions and facilities provided by JES3. Refer to Figure 3-1 for a list of these services.

JES3 SYSTEM INITIALIZATION

JES3 configuration and processing options are defined by a process called JES3 initialization. This process is controlled by JES3 initialization control statements and allows the user flexibility in tailoring JES3 to meet the specific needs of the installation.

JES3 initialization is the series of operations which JES3 performs to prepare for job processing on each processor where the JES3 system is started. Initialization occurs automatically as part of starting JES3, and is completed before JES3 begins to process jobs.

Initialization consists of:

- Loading the resident portion of JES3
- Formatting the JES3 queue devices, if necessary
- Allocating resources for JES3 library data sets, if necessary
- Defining job scheduling algorithms
- Defining installation standards
- Defining console message routing
- Defining the number of processors and the operating characteristics of each
- Establishing allocation tables for devices, volumes, and data sets managed by JES3
- Starting initial program load (IPL) of ASP main processors

JES3 initialization statements allow the system programmer to specify system options and configurations. All installations have different requirements and resources. Therefore, constructing an initialization data stream requires a great deal of planning and testing.

To assist, a starter initialization data stream is created during the system generation process. Parameters specified on the JES3 system generation macro instruction allow specific installation hardware configurations to be converted to initialization statements. Default values of non-hardware initialization algorithms such as buffer size and installation standards are assumed.

JES3 can be started in several different ways, depending on whether the installation wishes to change the initialization options and/or save jobs already in the job queue from the previous JES3 start. The types of system startup that invoke the initialization process are:

- *Cold start*: This sets all JES3 queues to empty. Cold start is the first start after system generation and may also be required during IPL following a system failure which damages the JES3 checkpoint record.
- *Warm start*: This allows some initialization statements to be modified. Jobs in execution on the global processor being warm-started are terminated from execution and are treated according to their automatic job recovery options. However, jobs in the job queue are not affected. An IPL must be performed for all remaining JES3 processors.

JES3 SERVICES

JES3 System Initialization

JES3 Job Management

- Input Service
- Interpreter Service
- Procedure Library Facilities
- Data Resource Management
  - Volume Fetching
  - Data Resource Allocation
  - Volume Mounting and Verification
  - Deallocation of Data Resources
- Job Scheduling
  - Generalized Main Scheduling
  - Deadline Scheduling
  - Dependent Job Control
- Job Execution
- Spool Data Management
- Job Output
  - Output Service Scheduling
  - Output Service Writers
  - External Writer Support
  - Internal Reader Support
- Job Cleanup – PURGE

Remote Job Processing (RJP)

- BSC RJP
  - BSC RJP Features
- SNA RJP
  - SNA RJP Features

Background Job Facilities for TSO Users

Console Services

- Multiple Console Support

General Routines

Utility Dynamic Support Programs

Figure 3-1. JES3 Job Processing Services

- *Warm start with analysis*: This allows the system programmer to validate the JES3 job queue during warm start processing. Any jobs that would result in an inability to restart the system can be deleted.
- *Hot start*: This does not allow a change of initialization statements, but allows jobs active on the global processor to continue unaffected. JES3 attempts to reinitialize itself without the cancellation of any jobs currently in execution. Local and ASP main processors do not have to have an IPL after a hot start.
- *Hot start with analysis*: This allows the system programmer to validate the JES3 job queue during hot start processing. Any jobs that would result in an inability to restart the system can be deleted; however, jobs that are active on another processor may continue to execute outside of JES3 control.
- *Local start*: This allows the local processor to be initialized. Initializing information for the local processor is provided by the global processor.

During JES3 initialization, the operator must specify which type of initialization is desired. On a cold or warm start, the operator must select the initialization stream to be used by specifying its library member name or address of the device used to input the initialization stream. Additional information about JES3 initialization may be obtained from the *OS/VS2 MVS System Programming Library: JES3 and OS/VS2 MVS JES3 Commands.*

JES3 JOB MANAGEMENT

This section describes JES3 job management functions and facilities.

Input Service

Input service consists of two phases, each consisting of several non-resident modules:

- *Reader phase:* Jobs are read from an input device and placed on a spool in batches.
- *Control statement processing phase:* Jobs are read from the spool and processed.

An input device may be a card reader, a tape unit, or a DASD supported by the basic partitioned access method (BPAM). Jobs submitted from either local or remote terminals are processed by input service as though they were coming from a local card reader. Input service also recognizes an input job stream from the internal reader facility. (See "Internal Reader" later in this chapter.)

A reader DSP transfers a predetermined number of jobs (a job batch) to the spool DASD. As each job batch is read, input service DSP reads each job batch and begins the JES3 control statement processing phase. This phase analyzes the JES3 control statements, builds JES3 control blocks, and writes the jobs and control blocks to the JES queue. For information about JES3 control statements , see Chapter 4. "Job Control Statements" and *OS/VS2 JCL.*

Interpreter Service

Interpreter service converts JCL statements to scheduler control blocks (SCBs) for use by the scheduler component in an OS/MVT, SVS, or MVS operating system. It also determines resource requirements and creates control blocks for use by the JES3 main device scheduler (MDS) function. Every job must pass through the interpreter service before it can be scheduled for execution. This service comprises primarily the reader/interpreter (RI) and converter/interpreter (CI) dynamic support programs (DSPs).

Whenever a job enters the system, input service selects one of the interpreter DSP scheduler elements (reader/interpreter for jobs eligible to run on ASP main processors, or converter/interpreter for jobs eligible to run on JES3 processors, or both if a job can run on any processor). For jobs eligible to run on either type of processor, the installation can choose one DSP as the default or choose both types; thus postponing the decision of the type of processor on which the job will run. Each interpreter DSP consists of the interpreter phase, the prescan phase, and the postscan phase.

The interpreter DSP interacts with a JES3 subtask to interpret JCL into system control program (SCP) scheduler control blocks (SCBs). The JES3 subtask can represent either a reader/interpreter (for ASP main processors) or a converter/interpreter (for MVS processors). The number of reader/interpreter and converter/interpreter subtasks may be specified during initialization and may be changed dynamically by the operator during system operation. Some subtasks may be dedicated to interpreting batch jobs and TSO logons.

The system programmer may define a standard system procedure library and multiple alternate libraries at JES3 initialization. Different standard system procedure libraries may be specified for use in interpreting batch jobs; TSO logons and started tasks. Then, a specific procedure library can be selected for utilization during the interpret phase DSP processing of a given job. Build list (BLDL) requests for frequently used procedures within the multiple libraries can be identified during initialization, resulting in improved efficiency and performance during interpreter DSP processing of the jobs using these procedures.

The PROCLIB update control facility allows updates to be made to a procedure library data set. After the library is updated, any specified BLDLs for that library are reissued.

The prescan and postscan phases use the SCP scheduler control blocks (called the scheduler work area (SWA) in MVS) created in the interpreter phase to create two primary outputs for use by the main device scheduler (MDS), the job summary table (JST) and the job volume table (JVT). These tables contain scheduling information, such as data set names, volumes serials, and unit device types, which is obtained directly from the SCP scheduler control blocks or indirectly from the system and user catalogs referenced during these two phases. If the information came from the catalogs and the Hierarchical Storage Manager (HSM) was active, there could be a list of volumes serials and unit device types associated with the data set name. This list is created for all data sets on an HSM-managed device. The list represents the possible volumes on which the data set could reside if it is migrated and recalled.

Creation of the MDS control blocks is identical for an OS/MVT, SVS, or MVS operating system. The critical option in creating MDS control blocks is choosing the type of setup for JES3-managed devices. The setup options available with JES3 are:

1. *Job Setup*: The interpreter assigns each unique volume used throughout the job to a separate device, except where JCL explicitly indicates otherwise. This type of setup generally improves job turnaround at the expense of efficient device usage.
2. *High Watermark Setup*: The interpreter assigns a number of mountable devices (discounting permanently resident or reserved volumes) of each device type equal to the maximum number of volumes required in any single job step, unless the JCL explicity indicates otherwise. This type of setup makes efficient use of devices, but may slow job turnaround due to dismounting and mounting of volumes.
3. *Explicit Setup:* The programmer specifies in a JES3 control statement which DD statements are (and which are not) to be setup.

The entire MDS function is optional, and additionally, the automatic setup options (job and high watermark) are separately selectable for DASD, tape, and MSS virtual devices. These options are supplied as an installation default and can be overidden by JES3 control statements.

In order to create an MDS control block structure that reflects all setup requirements, the interpreter accesses the system catalog to determine all volumes and devices required. Where JCL calls for an explicit user catalog (JOBCAT or STEPCAT DD statements) the interpreter will get the required catalog volume mounted, and access it instead of the system catalog. Implicit user catalogs and system catalog volumes (CVOLS) must be resident but are not dynamically mounted in this manner.

Jobs which are interdependent because of changes to a catalog must be included in a dependent job control (DJC) network. Until all DJC predecessor conditions are met, interpreter service processes a job only up to the point of resolving catalog references. This allows a job with JCL errors to be flushed early. Once all DJC predecessor conditions are satisfied, the interpreter is rescheduled to complete its processing.

Data Resource Management

The main device scheduler (MDS) is a JES3 facility that controls the setup of resources (devices, volumes, and data sets) associated with job execution on a processor. MDS services consist of volume fetching, allocation of data resources, volume mounting and verification, and deallocation of data resources. MDS services are part of the main scheduler element in normal job processing. Once a job is in execution, MDS services can also be invoked to process dynamic allocation requests.

The devices to be managed by MDS, and the unit names by which those devices are known (in JCL references) are defined during system initialization. These devices must be defined as part of the MVS or SVS I/O generation on one or more of the processors managed by JES3. Any configuration of shared devices between processors is permitted.

Three categories of devices can be attached to a processor:

- *Class 1, JES3-managed*: These are devices which are defined as removable in the JES3 initialization stream and which have no resident volume mounted. Volume mounting (if tape or direct-access) and access are to be controlled exclusively by JES3. Class 1 devices consist of tape devices, direct-access devices for mountable volumes, MSS virtual units, and any unit-record or graphic devices defined in the initialization stream.
- *Class 2, JES3-MVS jointly managed*: These are direct-access devices which are defined in the JES3 initialization stream, and whose status is permanently resident. They consist of direct access devices that contain permanently resident volumes or fixed-direct access devices.
- *Class 3, MVS-managed*: These are devices which are not defined in the JES3 initialization stream, and thus, are outside of JES3 control. Only MVS allocation is provided for class 3 devices. They must be accessed by names not identified to JES3. System wide volume and data set integrity is not provided by JES3 for devices of this type.

A description of the services performed by MDS for data sets on the devices that MDS manages follows:

Volume Fetching

MDS determines a job's requirements for mountable volumes and issues operator messages to a tape or DASD library, requesting that the required volumes be "fetched" to the computer area. As an installation option, after the issuing of these messages, MDS will either make the job immediately eligible for data resource allocation, or will wait for operator "go ahead" that the required volumes are available.

Data Resource Allocation

Data resource allocation facilities fall into three overlapping categories: 1) Selection of a job relative to other jobs competing for resources, 2) selection of an eligible processor on which to attempt allocation, and 3) assignment of devices, volumes and data sets to the selected job.

Selecting a Job: In general, jobs are considered for data resource allocation in priority order. The first job that can acquire data resources on an eligible processor will be granted those resources. There are exceptions to this priority consideration:

- Jobs ineligible to be selected for execution will not be allocated data resources; for example, jobs in a job class group that is not being selected by any processor.
- Job classes have a limit on the number of jobs of that class that can be allocated at any one time. Additional jobs in such a class will not be allocated data resources. This prevents jobs in one class from monopolizing use of devices.
- Jobs get bypassed for resource allocation because of higher priority jobs.
  Failure to acquire data resources does not necessarily prevent lower priority jobs from having them. For example, if three tape drives are available, a high priority job that requires four drives cannot successfully allocate, but will not prevent a lower priority job that requires only two tapes from doing so. Thus, all the data resources required by a high priority job may never become available at one time. To avoid this, MDS provides a "barrier reserve" feature which allows jobs with a priority at or above a specified "barrier" to reserve resources, and thus prevent jobs below the barrier priority from obtaining them. Likewise, low priority jobs may never be scheduled because of the presence of higher priority work. The MDS "priority aging" feature also provides a facility for increasing a job's priority when it has been bypassed for data resource allocation.

Selecting a Processor: Having selected a job for data resource allocation, MDS next chooses a "setup" processor eligible to run the job. MDS will allocate resources that are accessible from that processor.

This choice of a "setup" processor does *not* restrict the eligibility of that job to run on only that processor. In allocating devices, preference is given to devices that are shared by other processors eligible to execute the job. If all devices allocated to the job are shared by another processor, that processor also remains eligible to run the job.

Each processor has a "setup depth" which is a limit on the number of jobs requiring mountable devices that can be allocated on that processor at one time. In selecting a "setup processor" from among those eligible to run a job, MDS chooses the processor furthest below the setup depth.

Allocating Data Sets, Volumes and Devices: JES3 provides data set integrity protection across processors in the JES3 complex in accordance with the JCL-specified data set disposition. This means that a job which holds exclusive access to a data set will prevent other jobs from allocating successfully. For dynamic allocation, the time required to perform this function, including the required communication with the JES3 global processor, can be an overriding performance consideration, and JES3 provides an optional facility for bypassing this function for specific named data sets.

The dynamic allocation fast path (DYNAL) function of JES3 processes dynamic allocation requests to provide asynchronous I/O processing for single-volume, single-unit data sets on permanently-resident or reserved real DASD. Protection for other requests (JCL-specified or dynamically allocated) are provided by MDS.

The primary concern in allocating volumes is to minimize volume movement. MDS keeps track of the volume currently mounted on each device, and attempts to satisfy further requests for the volume on the device where it is already mounted. The operator can specify the serial number of a volume that is unavailable and MDS will not allocate jobs requiring such a volume until it is made available.

When a required volume is not already mounted or must be moved, MDS will make the device assignment. The number of mountable devices required, and how devices can be reused to mount different volumes, is predetermined by the JES3 interpreter, according to job setup, high watermark setup, or explicit setup algorithms.

The foremost consideration in making this assignment is the device "fence," a partitioning of the installation's devices for exclusive use by the jobs in a particular job class group or dependent job control (DJC) net. Another important consideration in assigning shareable devices is to try to match, or at least not further limit, the set of processors eligible to run the job. By maintaining the maximum "processor eligibility," the generalized main scheduler (GMS) can better achieve a balance of response and throughput in selecting jobs for execution.

MDS supports dynamic device reconfiguration (DDR) thru the subsystem interface.

Volume Mounting and Verification

Once all required resources have been assigned to a job, MDS issues "mount" messages, requesting that the operator mount the first required volume on a specified device. MDS then verifies that each volume has been correctly mounted by reading its volume label.

The installation can facilitate operations in accordance with the physical location of devices. In the assignment of devices, the installation controls the order in which devices are examined, so that equivalent devices can be assigned based on location. "Mount" messages are issued to a destination associated with the device so that the proper operator(s) will see the message.

Once all required volumes for a job have been mounted and verified the job is passed to the generalized main scheduler (GMS) for execution processing selection.

Deallocation of Data Resources

During job execution, MDS or DYNAL is notified, as each step completes, to deallocate resources that are not required by subsequent steps of the job (early resource release). Data resources may also be returned in the midst of job step execution via the dynamic deallocation subsystem interface. Finally, any resources still held at job end are released at that time. In all cases, returned resources immediately become available for assignment to other jobs.

Job Scheduling

JES3 functions as a resource manager and job scheduler. The scheduling and selection of jobs for execution are major functions of the job entry subsystem. JES3 provides a unique set of these functions that are especially designed for the multiprocessing environment. These functions are *generalized main scheduling*, which determines which jobs should be scheduled to execute on a processor; *deadline scheduling*, increasing the priority of a job when it has been scheduled by to make the best use of the available resources; and *dependent job control* which allows jobs to be executed in a specified order.

JES3 job scheduling provides flexibility in balancing the installation's workload among JES3 processors. When a system initiator becomes available for job processing, JES3 selects a job within the available classes from among jobs requiring no setup volume mounting, or from jobs whose setup requirements have been met.

The user may submit a job with the option to execute on any processor in the JES3 complex, which includes the global processor, any local processor, or any ASP main processor. JES3 selects the processor based on processor availability and selection constraints defined by the job or installation.

Selection of a job for a processor is based on the capacity of that processor to provide sufficient resources. JES3 supports pooled devices among processors to further control job/processor selection.

Generalized Main Scheduling

Jobs are selected for execution by the generalized main scheduling (GMS) facility of JES3. Initialization parameters define the characteristics of each processor, job-selection mode criteria, and jobs categorized by class. When GMS parameters are not specified, default values are used.

The dedicated initiator count for each group may be varied from default values during system initialization or by an operator command. The number of initiators dedicated to each group determines the number of jobs that may run concurrently on that processor.

The system programmer may specify options to control the allocation (starting) and deallocation (stopping) of initiators for each defined job group. Allocation and deallocation can be performed either automatically or in response to operator command. The options are chosen to maximize initiator availability and to minimize initiator start/stop overhead.

The system programmer may also define by job class the job I/O rates to affect the mix between jobs having high I/O rates and jobs having high processing unit requirements. A proper mix of jobs with different I/O to processor ratios produces better system throughput than would be produced by random selection. The ratio may be specified for each job through a JES3 control statement or may assume a default value by job class. GMS uses the priority parameters specified at initialization to help select jobs for execution. The hierarchy of priorities is:

1. Processor priority (dynamic)
2. Job group priority (ASP main processor only)
3. Job class priority

The processor priority is determined dynamically, based on load, and is not subject to external specification or modification. (Dynamic processor priority is available only on MVS processors.) The groups are ordered according to the PRTY parameter specified on the GROUP statement, and the jobs are placed in order within the groups according to the PRTY parameter on the CLASS statement.

The priority aging feature allows JES3 to increase the priority of a job after it has been passed over for selection by JES3 an installation-specified number of times, because of a low priority relative to that of other jobs in the system. At an installation-specified priority barrier JES3 will attempt to prevent lower priority jobs from capturing idle resources if they are known to be needed by a job at or above the barrier priority.

Deadline Scheduling

Most data processing installations must process a certain class of jobs by a particular time in order to meet required schedules. Deadline processing increases the JES3 priority of a job based on initialization parameters. Although deadline scheduling normally functions without operator action, console commands are provided to allow operator modification of deadline scheduling parameters.

Deadline scheduling provides job scheduling algorithms that increase the probability of a job being scheduled by a specific time. The job's selection priority may be dynamically incremented as the job approaches its deadline for entering execution.

The deadline scheduling feature allows the installation to specify a time of day by which the job should be scheduled. If the job is not scheduled by this time, JES3 will increase the priority of the job at user-defined intervals until it is scheduled.

Dependent Job Control

Dependent job control (DJC) allows jobs to be executed in a specific order. DJC is a function within the JES3 system that manages jobs that are dependent upon each other. Job dependencies may occur because of data dependencies; they may be defined so as to achieve better device utilization; or they may be defined so as to manage job streams. For example, job A might produce output on tape that job B requires as input, and job B might produce output on tape that job C requires as input. Figure 3-2 illustrates this simple dependent job network, where job B is a successor to job A, and job C is a successor to job B.

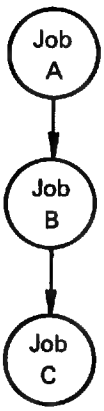


Figure 3-2. Simple Dependent Job Control Network

Job dependencies of a more complex nature are typical. As an example, DJC will manage the scheduling of the complex network illustrated in Figure 3-3.

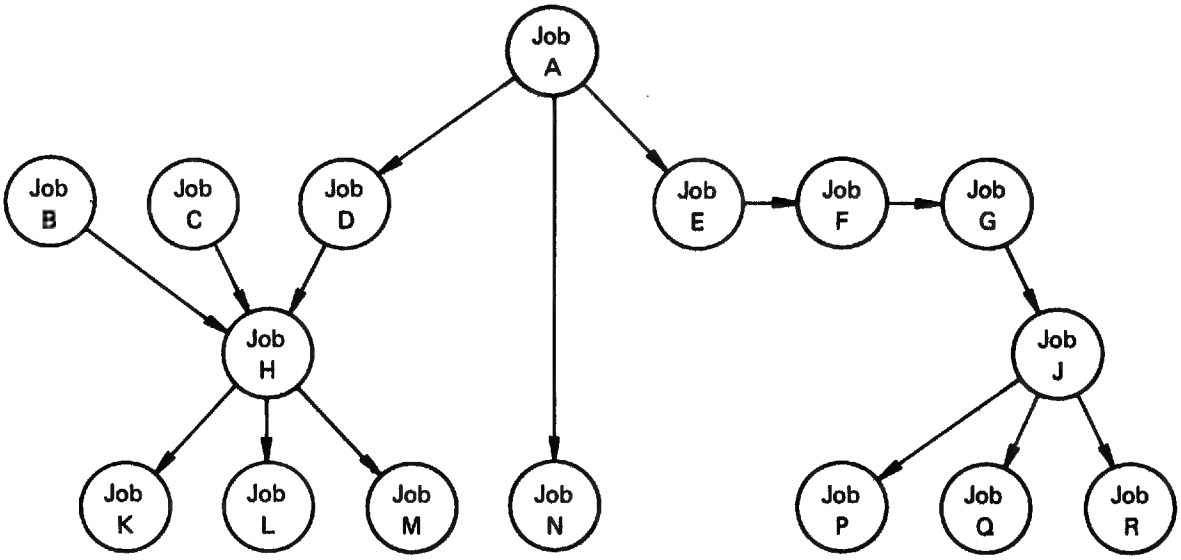


Figure 3-3. Complex Dependent Job Control Network

The application programmer defines dependent job control networks through specifications in the job's JES3 control statements. No operator action is required to invoke DJC, but operator commands are provided to query and alter DJC specifications.

Using dependent job control (DJC), an installation can cause JES3 to control job selection based on dependencies among jobs. With JES3 control statements, the user can specify that one set of jobs (predecessor jobs) be completed ahead of other jobs (successor jobs). Jobs in a DJC network are held after JCL interpretation and before catalog resolution until predecessor jobs have completed execution or have indicated to JES3 that critical processing is complete. This ensures that catalog and data set dependencies are resolved before successor jobs are executed. A device pool can be assigned to a set of jobs under DJC, ensuring the availability of critical devices when needed.

Dependent job control (DJC) allows simple or complex job interdependencies that are present in many commercial data processing installations to be scheduled through JES3. The success or failure of one job can cause execution, holding, or cancelation of other dependent jobs or of jobs in other networks.

Devices can be pooled (fenced) for use only by jobs in DJC networks or job-class groups. This allows devices to be reserved for jobs with known device requirements. The installation can specify that these are the only devices to be used, or that a job may go outside the device fence to allocate devices if enough are not within the fence.

Job Execution

The main service support function controls job execution processing within the JES3 complex on the global processor (MVS), local processors (MVS), and ASP main processors (MVT or SVS).

The main service DSP on the global processor interfaces directly with jobs running on the global processor, each local, and ASP main processor. Main service performs the following functions in support of executing jobs:

- Provides input/output support for data sets transmitted across the CTC adapters for ASP main processors
- Monitors job execution on ASP main processors by analysis of processor console messages and performance statistics (line and card output volume) to detect abnormal performance and to take a user-specified action when difficulty is detected
- Provides operator communication to, and control of, the processors

Spool Data Management

JES3 spool data management is a collective term applied to the set of modules that control the allocation and use of space on spool data sets. Spool data sets contain SYSIN/SYSOUT data as well as job-related and system-related control blocks. JES3 spool data management can run in a mixed spool environment that supports the IBM 3330, IBM 3340, and IBM 3350 Disk Storage devices. In addition, extended error recovery is provided for JES3 spool volumes. If a JES3 local or global processor fails, the JES3 jobs executing will not lose any of their output that was written to the spool queue.

That part of JES3 spool data management that is responsive to JES3 address-space requests is called the JES3 spool access method (JSAM). JSAM subroutines perform allocation and deallocation of buffers and records, opening and closing of single-record and multirecord files, blocking and deblocking of data, and other spool-file services. The programs that execute in a non-JES3 address space are collectively known as the user spool access method (USAM). USAM subroutines provide the subsystem interfaces for allocation/deallocation and OPEN/CLOSE of user address space SYSIN/SYSOUT data sets. They also provide the user with address space spool-file services. Common service routines used by these two access methods include track group allocation and I/O initiation/termination processing.

Although spool space allocation requests are handled solely from within the JES3 address space on the global processor, the actual spool access I/O operations are performed from within the originating address space on any processor in the system. This is known as the shared spool concept, under which JCL and SYSIN data are written to the shared spool from the global processor. Then the MVS processor that is selected to execute a particular job is given the location of the data and accesses it directly. Similarly, SYSOUT data is written to the shared spool from the processor that creates the data and is read from the spool by the global processor for transmission to an output device.

The use of a shared spool eliminates duplication of some I/O operations and makes the dynamic system interchange (DSI) facility possible. SYSIN, SYSOUT, and reader/interpreter data for jobs executing on attached ASP Version 3 main processors continue to be transmitted between processors by the CTC adapter.

Job Output

The output service function processes SYSOUT data sets. The data sets may be destined for print, punch, TSO on ASP Release 3.1 main processors, MVS TSO, external writers or the internal reader. Output service consists of two distinct phases: scheduling and writing.

Output Service Scheduling

The output service scheduler extracts writer output characteristics of SYSOUT data sets from the JCL parameters, the SYSOUT class table constructed from initialization parameters, and //*FORMAT JES3 control statements. These characteristics are:

- Data set priority
- Data set destination
- Device type
- Forms
- Carriage tape name or forms control buffer
- Train name
- Number of lines of printed or punched output
- SYSOUT class
- 3800 characteristics

The output service writer uses these characteristics to select data sets for processing.

Output Service Writers

An output service writer is a collection of modules that writes to a given output device. A unique writer is started for each defined output device. Depending on the method of starting and stopping the writers, a writer may be classified as either a hot writer or a dynamic writer.

The operator controls a hot writer and its associated device through operator commands. Data set characteristics are associated with the writer when it is started. When no more data sets with those characteristics are available, the writer notifies the operator that it is waiting for work and is available to process data sets with the defined characteristics. The operator may modify the selection characteristics associated with the hot writer or may force the writer to terminate.

The starting and stopping of dynamic writers and their associated devices are controlled by JES3 output service scheduling. As a data set with given characteristics becomes available for processing, a writer is automatically started on an available device, and the system creates any necessary mounting instructions for forms, train, or forms control buffer. When there are no more data sets that can be processed on that device the writer automatically terminates.

External Writer Support

The output service external writer support allows system output data to be produced and queued for installation-written output writer routines. JES3 subsystem interface routines are used to retrieve the output data from the JES3 queues.

Internal Reader Support

The internal reader facility provides the means for a JES3 output data set to be passed to JES3 input service and processed in the input job stream, thus allowing jobs and started tasks to submit jobs to JES3 for processing. Multiple jobs can be received simultaneously by the internal reader. MVS utilizes the internal reader to pass JCL for started tasks, TSO logon, and TSO background jobs to JES3. Any job executing in MVS can use the internal reader to pass a job to JES3.

Job Cleanup–PURGE

The purge function is the last processing function for a job in the JES3 system. It releases all the job's assigned JES3 DASD space, making it available for allocation to subsequent jobs. A message is issued to the operator indicating that the job has been purged from the system.

REMOTE JOB PROCESSING (RJP)

Remote job processing permits the input and output of jobs to and from terminals that are remote from the installation. JES3 supports remote work stations which use either binary synchronous communications (BSC) or system network architecture remote job processing (SNA RJP) communications protocols. RJP provides the facility for attaching both BSC remote terminals and SNA RJP remote terminals simultaneously as remote card readers, printers, card punches, and consoles with job output routed to any remote terminal or local output device. Once a job has been submitted from a remote terminal, it is processed the same as if it were entered from a local reader.

BSC RJP

BSC remote job processing permits the input and output of jobs to and from terminals that are remote from the installation over binary synchronous communications lines. Line control is provided by the remote terminal access method (RTAM), a component of JES3. RTAM provides an interface between a JES3 DSP and the remote terminal.

BSC RJP supports two types of remote terminals; nonprogrammable, or hardware terminals and programmable, or intelligent terminals. Nonprogrammable terminals (such as 2770, 2780, 3740, 3770, and 3780) are supported in a noninterleaved mode. This means only one device at a terminal can be active at a time. The programmable work stations (such as the 1130, system/3, system/360 model 20, and the system/370 models 115 and 125) are supported in an interleaved mode called "MULTI-LEAVING" that permits concurrent job input and output.

The remote work station package program for the programmable terminals can be generated on any MVS system on which JES3 is installed.

BSC RJP Features

BSC RJP provides the following features for remote job processing.

- *Remote BSC terminals*: These terminals may be connected by either leased or dial-up transmission lines. Communication lines of any speed supported by the hardware are also supported by JES3.
- *Background utilities*: These utilities may be used with BSC RJP card readers, printers, and punches. The input unit on a nonprogrammable terminal must be used only for batch processing of jobs, but the output units are available for callable dynamic support programs (DSP). The same applies to readers defined as automatic readers on the /*SIGNON card. The DSPs that may be called are card-to-card (CC), card-to-printer (CP), card-to-tape (CT), card reader (CR), tape-to-card (TC), and tape-to-printer (TP). Tape devices are not supported on remote work stations; therefore, DSPs using tape must have the tape unit on the central system.

- *Interface with remote terminal processor (RTP) programs*: JES3 BSC RJP is designed to operate with the remote terminal processor (RTP) program created as a result of RMT generation. RTP programs are available for the 1130 Computing System, System/360, Model 20, System/3, System/360, and System/370.
- *Password protection*: An 8-character password may be assigned to each RJP line and/or terminal by the system programmer.
- *Logical terminal support*: All communications are established by the remote work stations. The remote operator submits a sign-on statement to identify the terminal.
- *Remote console support*: Support is provided for the remote terminal console as a full-function JES3 operator console, as a console to control work originating from that terminal, or as an inquiry-only console. Terminals that do not have a real console may be defined as having a simulated console. In this case the console commands are entered through the card reader, and console messages are printed on the terminal printer.
- *Error recovery*: RJP automatically attempts all error recovery procedures.
- *Error statistics*: RJP records line error statistics and, on request, presents them to the operator.
- *Interleaved unit-record operation on programmable terminals*: Multiple printers, punches, and card readers (to a maximum of 15 devices – seven input to JES3, seven output from JES3, and one console) in addition to console operations, may be concurrently active on a terminal. (This may be further limited also by the hardware configurations allowed for the individual work station.) Jobs submitted from remote terminals follow the same RJP programming conventions as those established for jobs submitted locally. Output from remotely submitted jobs may be returned to any terminal specified by the submitter or may be processed locally. If default output routing is used, output will be returned to a terminal within a terminal group from which the job was entered.
- *2770/3780 blank compression*: This feature permits from 3 to 63 consecutive blank characters to be represented by 2 characters, thus improving transmission efficiency.
- *Message queuing for terminals that are signed off*: If a remote console is signed off or otherwise unable to accept a transmission, any messages are queued until they can be printed on the console.
- *Job-related messages to the terminal of origin*: Job started, job ended, and abnormal termination messages are routed to the RJP terminal submitting the job.
- *Remote 3211 printer FCB loading*: JES3 supports forms buffer loading for 3211 printers on RJP terminals.
- *Output suspension for nonprogrammable terminals*: Printing can be suspended at a remote printer so that input data can be sent from the remote card reader to JES3, then output resumed for the data set.
- *Inquiry by data set origin and destination*: The operator can determine if there is any RJP output for a given terminal by data set destination or origin.

- *SMF Records:* SMF records are built for each terminal signon, signoff and line start.

SNA RJP

JES3 provides the systems network architecture remote job processing (SNA RJP) facility to allow remote work stations to communicate with the host computer through the virtual telecommunications access method (VTAM) and the network control program (NCP) in the channel-attached communications controller (3704 or 3705).

SNA RJP extends remote job processing to include SNA data transmission protocols in addition to binary synchronous communication (BSC) protocols. SNA RJP allows JES3 to receive jobs and console messages

from and to return SYSOUT data and console messages to remote SNA work stations. JES3 SNA RJP supports processing units which have the IBM 3770 Data Communication System or the IBM 3790 Communication System attached. The IBM 3790 Communication System can be attached by local channel attachment of synchronous data link control (SDLC) lines. For more information on systems network architecture, see *Systems Network Architecture General Information.*

Features of SNA which the JES3 SNA RJP user will be able to utilize include:

- Local or remote attachment of SNA terminals.
- Logical device interfaces. Disks, diskettes and tapes at the remote terminal are accessed by JES3 through an architectural-defined reader, printer, or punch interface.
- Multidropped lines. Lines sharing with terminals in sessions with JES3 or other VTAM applications.

For details on SNA RJP supported devices, see Chapter 8, "JES3 System Configuration Options."

SNA RJP Features

Features of the SNA RJP facility include:

- *SNA data transmission protocols*: SNA RJP uses the LUTYPE1 transmission protocols to communicate with remote work stations.
- *Multiple logical unit support*: Concurrent transmission of data is supported between JES3 and the console, readers, and printers attached to a work station which supports multiple logical unit sessions with JES3.
- *Compression and compaction*: JES3 SNA RJP supports compression of data inbound or outbound and compaction outbound for those work stations which support compression and/or compaction inbound or outbound. Compression removes repeated characters from a data stream. Compaction provides an ability to combine user-specified pairs of characters into a single byte in a data stream for improved transmission line efficiency. The characters that can be specified are user-supplied. User-specified compaction tables may be selected on SYSOUT class basis or data set basis or as a remote work station.
- *Support of ASCII*: SNA RJP supports transmission of data to and from work stations in ASCII as well as EBCDIC.

  Note: *Compression/compaction and ASCII are mutually exclusive.*

- *Selectable parameters*: Compression, compaction, ASCII and transmission block size can be selected by the operator at logon.
- *Remote printer setup*: For those work stations which support the SNA peripheral data stream information record (PDIR), the forms, trains, and forms control buffer can be established by a single transmission of a PDIR from the host computer. For work stations that do not support the SNA PDIR, forms and train setup is requested by operator message, and the FCB image is translated into an SCS (SNA character string) set vertical format (SVF) sequence and transmitted to the remote terminal.
- *Multiple output copies*: Multiple copies require only a single transmission of data from the host computer for those work stations which support the PDIR.
- *Accounting information*: SMF recording is supported for SNA work stations.
- *Selectable output data recovery levels*: Acknowledgement of outbound transmission of data may be the basis of a data set, a page, a number of pages or a number of logical records, depending on the user's error recovery requirements.
- *Remote console support*: Support is provided for the remote terminal console as a full-time JES3 operator console, as a console to control work originating from that terminal, or as an inquiry-only console.

Terminals that do not have a separate console printer may be defined as having a simulated console. In this case the console messages are printed between data set boundaries on the remote terminal printer.

- *Message queuing for terminals that are signed off*: If a remote console is signed off or otherwise unable to accept a transmission, any messages are queued until they can be printed on the console.
- *Job-related messages to the terminal of origin*: Job started, job ended, and abnormal termination messages are routed to the terminal submitting the job.
- *Inquiry by data set origin and destination*: The operator can determine if there is any RJP output for a given terminal by data set destination or origin.
- *Password protection*: An 8-character password may be assigned to each SNA RJP remote station by the system programmer.

BACKGROUND JOB FACILITIES FOR TSO USERS

JES3 TSO support allows normal input, processing, and output of jobs from TSO terminal users. To the TSO user, JES3 processing of a job may not be apparent; however, JES3 can be used to enhance the TSO environment.

TSO users on ASP main processors can submit background jobs for execution and use JES3 statements to define the desired output. The operator of a TSO terminal on an ASP main processor can submit jobs to JES3 to be run on any processor. If a TSO terminal is attached to an ASP main processor, JES3 does not process the LOGON command; it is handled by the ASP main processor. Data set spin off, dynamic deallocation, and the TSO OUTPUT command are not supported for the ASP TSO user. For more information on JES3 support of TSO on ASP main processors see *OS/VS2 MVS System Programming Library: JES3*.

JES3 support of TSO terminals attached to MVS processors is provided by subsystem interface (SSI) routines that communicate requests between the TSO address space and the JES3 global address space. SSI routines are provided to support TSO STATUS, CANCEL, and OUTPUT commands as well as dynamic allocation requests. Jobs introduced using the TSO SUBMIT command are passed from TSO to the JES3 global processor by way of the internal reader. Output from a TSO job executing on an MVS processor may be held on the JES3 shared spool where it can be directly accessed by the TSO user.

CONSOLE SERVICES

Console service, a group of modules resident in JES3, enables communication between the operator and JES3. The two classes of communication are:

- *Input messages*. These messages are initiated by the operator and consist of commands or action responses directed to JES3 or to specific processors. Input commands may also be entered through the input stream.
- *Output messages*. These messages are initiated by the JES3 dynamic support programs (DSPs) or by any processor. They consist of job status messages, replies to operator inquiries, and messages requiring operator action.

Console service performs the following functions:

- Reads commands and responses into the system from the console.
- Checks the validity of commands entered according to the level specified on the appropriate JES3 CONSOLE initialization statement.
- Interprets the commands and responses.
- Routes input commands to the system functions that perform the required actions.
- Queues commands and responses that are to be sent to the consoles from the DSPs.
- Writes messages and responses to the consoles.
- Performs automatic switching in the event of console failure, if desired.
- Routes MVS messages to JES3 consoles according to installation-specified parameters.
- Allows entry of operating system commands for any processor from JES3 consoles on the global processor.

The JES3 DSPs use the MESSAGE macro to communicate with the operator at a specific console or a class of consoles. The operator communicates with the DSP through JES3 operator commands.

The asynchronous message processing program of a DSP receives control directly from console service whenever a message is received for the DSP. This message-processing program performs the following tasks:

- Evaluates whether to accept or reject the message, or to request that console service queue the message to be retrieved later.
- Sets up the necessary conditions to cause the message to be acted upon when the DSP is next dispatched by JES3.

Console service displays the sense bytes, status bytes, and operation code of all console error conditions.

Multiple Console Support

JES3 interfaces with the multiple console support (MCS) feature of MVS. This facility provides a convenient method of managing a configuration that contains active MCS consoles in addition to JES3 consoles. JES3 examines the route code specified on all write-to-operator (WTO) macro instructions and directs the message to the appropriate JES3 and/or MCS console based upon initialization or operator-specified routing parameters. MVS commands for a specific processor can be entered either from an MCS console on that processor or from a JES3 console on the global processor.

GENERAL ROUTINES

JES3 general routines are those modules and routines that are frequently used to perform JES3 supervisory functions. These routines are resident in the JES3 nucleus and perform such functions as the manipulation and modification of the job queue and other internal JES3 tables.

UTILITY DYNAMIC SUPPORT PROGRAMS

JES3 supports a number of special background utility programs that are executed in parallel with the other support functions of JES3. The operator may initiate these programs from a console. The unit-record devices to be used for input and output can be local devices or BSC RJP remote devices. The dynamic support programs supplied with JES3 are described in following paragraphs.

Card-to-Card DSP

The card-to-card (CC) DSP reproduces cards as a background JES3 utility function. Either EBCDIC or BCD cards may be reproduced. Options are available to perform the following:

- *BCD to EBCDIC conversion*: BCD card codes that represent dual characters are translated to EBCDIC.
- *Sequencing of the reproduced cards*: Sequencing is controlled by initial value and incremental value. The sequence information is punched into columns 73 through 80 if gang punching is not specified.
- *Gang punching*: Any character that can be typed at the console may be used, except the single quote. Gang punching occurs in column 73 through the column necessary to accommodate the number of specified characters.
- *Sequencing, gang punching, and field rearrangement*: These are under the control of JES3 control cards, which are included in the original deck being reproduced.
- *Multiple copies*: Each input card may be copied as specified.
- *Interpretation of output*: This is performed where possible.

Card-to-Printer DSP

The card-to-printer (CP) DSP lists EBCDIC cards on the global processor. Output may be single, double, or triple spaced. Fields may be rearranged through the use of control cards. Printing may be expanded across 120 print positions.

Card-to-Tape DSP

The card-to-tape (CT) DSP stores card files on reels of tape.

Dump Job DSP

Dump job (DJ) DSP is a background JES3 utility that is designed to dump jobs from the JES3 job queue to tape and at a subsequent time to reintroduce those jobs back to the queue at the stage of processing they had reached when dumped. Operands are available to select the jobs to be dumped to and from the system.

Tape Dump DSP

The tape dump (TD) DSP permits the dumping of 7- or 9-track tapes to a printer. The DSP has the capability to position the tape before dumping and to skip unwanted files and records.

Tape Label DSP

The tape label (TL) DSP produces tapes with standard labels or initializes unlabeled tapes with an end-of-file header.

Tape-to-Card DSP

The tape-to-card (TC) DSP punches tape files onto cards. When the TC DSP is scheduled, it prints a mounting message indicating the tape unit and punch to be used. After making both units ready, the operator issues a command to start the operation.

Tape-to-Printer DSP

The tape-to-printer (TP) DSP permits printing of job-generated 7- or 9-track tapes.

Tape-to-Tape DSP

The tape-to-tape (TT) DSP duplicates tape files within the JES3 system. Parameters are used to describe the characteristics of the input and output tapes and to specify any positioning requirements. Upon completion, the input tape is rewound, and the output tape remains positioned to add additional files.

Chapter 4. INSTALLATION INTERFACES WITH JES3 SERVICES

This section provides a general description of the interfaces with which the user (installation system programmer, operator, or application programmer) can control JES3 processing. Figure 4-1 provides a list of these services.

INITIALIZATION CONTROL

JES3 initialization is the series of operations which JES3 performs each time it is started to prepare for job processing. Initialization occurs automatically as part of starting JES3, and is completed before JES3 begins to process jobs. During initialization, JES3:

- Loads its resident modules.
- Locates and initializes all external devices and spool volumes.

Installation Interfaces with JES3 Services
Initialization Control
• JES3 Procedure
• MSS Table Build Program
• Initialization Statements
Operator Interface
• Operator Commands
JCL
JES3 Job Control Statements
IBM-Supplied User Exits
User-written DSPs
SMF
External Writers

Figure 4-1. Installation Job Processing Services

- Initializes internal tables and the subsystem interfaces.
- Builds its control blocks and user buffer pools.

The way in which JES3 initializes itself depends on how JES3 is started and on the contents of the initialization data stream. Any specific functions that JES3 supports but are not defined in the initialization data stream, such as 3850 Mass Storage System (MSS) device configuration, must be defined to JES3 prior to system initialization. At the time JES3 is started, the operator specifies the type of JES3 start for the global processor (hot, hot with analysis, warm, warm with analysis, or cold) or local processor (local start), and the location of the initialization data stream.

The installation controls JES3 initialization by modifying the JES3 default procedure, by updating (or respecifying) the default initialization deck, and by specifying the type of JES3 start.

JES3 Procedure

The JES3 cataloged procedure used in starting JES3 identifies the data sets which are required for JES3 processing. Among the data sets that can be specified in this procedure are spool data sets, procedure library data sets, table build data sets for MSS, and disk reader data sets. For a complete list of these data sets, refer to the *OS/VS2 MVS System Programming Library: JES3.*

Mass Storage System Table Build Program

The MSS Table Build program defines the MSS virtual device configuration to JES3 using the output of the Mass Storage Control Table Create program. Therefore, MSS virtual devices do not have to be defined in the initialization data stream.

The MSS table build program is executed following each execution of the mass storage control (MSC) table create program. These programs must be executed prior to JES3 initialization to ensure that the correct device and unit name configurations are known to JES3. The MSS table build program produces the JSMSSTAB data set, which provides input to JES3 cold start and warm start initialization.

If the MSS configuration changes, the MSS MSC table create and MSS table build programs must be executed again. For more information on the MSC table create program, see *OS/VS Mass Storage System (MSS): Installation, Planning, and Table Create.* The MSS table build program is discussed in detail in *OS/VS2 MVS System Programming Library: JES3.*

Initialization Statements

The JES3 initialization data stream is a sequence of statements in card image format which defines to JES3 the system configuration and job processing options desired by the instralation. The initialization data stream is interpreted by the global processor during a cold or warm start. A processor performing a hot or local start uses tables created by the global processor based on the last initialization data stream read.

The initialization data stream may be read from a card reader or from a member of a partitioned data set defined in the JES3 procedure.

JES3 initialization statements are summarized in Figure 4-2.

Statement	Function
ACCOUNT	Specifies default DSP accounting information.
BADTRACK	Identifies a defective track on the spool volume and prevents JES3 from using it for subsequent allocations from spool.
BUFFER	Establishes the JES3 buffer pool and the size of JES3 DASD records.
CIPARM	Specifies variable converter interpreter parameters.
CLASS	Specifies the characteristics of the JES3 job class.
COMMDEFN	Identifies the optional user communication system interface (VTAM) parameters.
comment	Provides the facility for comments in the initialization data stream.
COMPACT	Defines the compaction table to JES3.
CONSOLE[1]	Specifies the characteristics of an operator console and assigns message classes to it.
CONSTD	Establishes console-related installation standards for line-editing, buffering, and message logging.
DEADLINE	Establishes deadline scheduling algorithms.
DEVICE[1]	Specifies the characteristics of each device assigned to JES3.
DYNALLOC	Dynamically allocates a data set which otherwise would be described in the JES3 procedure.
ENDINISH[1]	Identifies the end of the initialization data stream.
ENDJSAM[1]	Identifies the end of the JES3 I/O statements which precede the bulk of the initialization data stream.
FORMAT[2]	Requests formatting for the JES3 spool data set.
GROUP	Specifies the characteristics of JES3 job class groups.
HWSNAME	Identifies groups of I/O units for high watermark setup.

[1] Required.
[2] Either a FORMAT statement or a TRACK statement is required for each data set.

Figure 4-2 (Part 1 of 3). JES3 Initialization Statements and Their Functions

Statement	Function
INTDEBUG	Provides the facility to generate a dump associated with an initialization error message.
IPL Deck	ASP main IPL deck.
JES3LIB	Dynamically allocates and concatenates one or more JES3 STEPLIB data sets.
MAINPROC[1]	Identifies and specifies the characteristics of each processor in the JES3 complex (including ASP mains).
MSGROUTE[1]	Establishes MCS message route codes for each JES3 processor.
NJPTERM	Specifies remote terminals and line ddname associations for network job processing.
OPTIONS	Specifies certain options for the JES3 system.
OUTSERV	Specifies output service defaults and standards.
PFK	Associates an operator command with a program function key or selector pen.
PROC	Identifies frequently used procedures.
RESCTLBK	Specifies that main storage be preallocated for the high usage function control table (FCT) and the resident job queue (RESQUEUE) tables.
RESDSN	Specifies the names of frequently used permanently resident data sets.
RIPARM	Specifies OS reader/interpreter options for ASP main processors.
RJPLINE	Specifies the characteristics of a single BSC line as it is used by the JES3 global processor for remote job processing.
RJPTERM	Specifies the characteristics of a remote terminal for remote job processing.
RJPWS	Specifies the characteristics of a remote work station for SNA RJP.
SELECT	Specifies the scheduling parameters for job selection modes.
SETACC	Defines nonshared permanently resident direct access volumes prior to processor initialization.

[1] Required.
[2] Either a FORMAT statement or a TRACK statement is required for each data set.

Figure 4-2 (Part 2 of 3). JES3 Initialization Statements and Their Functions

Statement	Function
SETNAME	Specifies groups of devices within device types.
SETPARAM	Specifies main device scheduler (MDS) parameters for allocating I/O devices.
SETRES	Specifies which direct access volumes are to be made JES3 mounted at main processor initialization.
STANDARDS	Specifies standard default values and job options for the JES3 complex.
SYSOUT	Specifies the characteristics of a SYSOUT class.
TRACK[2]	Identifies a formatted volume that is allocated for the spool data set.

[1] Required.
[2] Either a FORMAT statement or a TRACK statement is required for each data set.

Figure 4-2 (Part 3 of 3). JES3 Initialization Statements and Their Functions

OPERATOR INTERFACE

From the global processor, the console operator monitors the work flow of the JES3 complex and can modify specific elements of the environment to tune system performance dynamically. Other operators control the devices attached to the global JES3 system (such as printers, card readers, and card punches), mount and demount the global and local processor mountable units, manage the disposition of special volumes, and monitor the flow of jobs through the system.

Each JES3 support function (processing stage) responds to a number of operator commands that permit the operator to cancel job processing, to start processing, or to resume processing after an operator intervention request. Some functions, such as output service (at the print or punch stage), provide additional options. For each printer, processing can be restarted either at the beginning of the data set or job or at a point a given number of lines (or pages) forward or backward. The restart can be accomplished on the same printer or on a newly assigned printer. In addition, a request can be made to reload the universal character set (UCS) buffer of a local printer. Background programs can be invoked from an operator console as well as from the input JCL and JES3 control statements.

The JES3 console inquiry function permits the console operators on the global processor to determine the status of the JES3 queues, the status of a given job in the queues, the amount of space left in the JES3 job queue, a summary of the workload backlog, and the status of the workload for any JES3 processing stage. This inquiry feature also permits the operator to determine whether the backlog is adequate or too high. With this information, and with the capability of changing job priorities or of placing a job in hold status and later releasing it for processing, the operator can manage the system. An operator can also inquire into

the status of functional components of JES3, such as the buffer usage currently in use, or invoke a support function that will display the entire system's status on a printer attached to the JES3 global system. At every stage of processing, the operator can maintain operational control by:

- *Deleting a job:* The operator can delete a job from the system by issuing the cancel option of the *MODIFY command from the console.

  Note: *MSS operations already started are not canceled.*
- *Restarting job processing:* The operator can restart applicable job segments on the global processor by issuing the *RESTART command at a console.
- *Changing job priority:* The operator can change the priority of a particular job, usually to expedite job processing for the job.
- *Holding and releasing a job or an entire priority level in the queue:* The operator can withhold a job from processing or release a job previously in hold status. He can do this either on the basis of priority or, if the jobs were received from remote work stations, on an individual terminal basis. The operator can release all or a specified number of jobs in hold status from a particular terminal.
- *Initiating batch support functions:* Using the *CALL facility, the operator can request that the system schedule support functions (such as card-to-tape or tape-to-printer) to be executed concurrently with the standard preprocessing and postprocessing functions.
- *Dynamically reconfiguring global processor input/output devices:* The operator can remove, make available, or reroute output for devices managed by JES3 or devices under operator control.

Operator Commands

The operator communicates with JES3 using JES3 commands through the operator consoles attached to the global processor or remote workstations, or through the input stream using job control language (JCL).

Operator consoles provide two-way communication between the operator and the various support functions of the global processor. JES3 output messages can be directed to specifically designated function-oriented consoles.

JES3 JOB CONTROL LANGUAGE

JES3 analyzes a job's JCL parameters to determine the job's data set, volume, and unit allocation and serialization requirements in order to perform job setup and inter-CPU data set integrity processing.

Some JCL parameters take on additional meanings or usage when JES3 is the primary subsystem. For example, job priority makes special use of JCL parameters. The JOB, EXEC, and DD statements contain parameters with special JES3 meaning. Specific JES3 information regarding JCL can be found in *OS/VS2 JCL.*

JES3 JOB CONTROL STATEMENTS

JES3 control statements are used by the application programmer to control the processing of jobs through JES3. Control statements are optional. If they are not specified, default JES3 job processing options will be used. Control statements are included in the JCL for a job following the JOB card. Control statements can direct a job to a specific processor, define data sets as input to DSPs (such as OUTSERV), and communicate special destination and format related instructions to the system for processing the print and punch data sets.

JES3 control statements are as follows:

DATASET: This statement defines the beginning of an additional input stream data set that can contain JCL and/or data.

ENDDATASET: This statement terminates the creation of a JES3 input stream data set that was defined in the DATASET statement.

FORMAT AC: This statement routes JES3 data sets to TSO users running under ASP main processors.

FORMAT NJP: This statement defines the remote network job processing (NJP) station from which and to which the job will be transmitted.

FORMAT PR: This statement specifies print characteristics of a JES3 output data set.

FORMAT PU: This statement specifies punch characteristics of a JES3 output data set.

MAIN: This statement defines the processor requirements for the current job. Many of the parameters are used to override parameters of the STANDARDS initialization control statement.

NET: This statement defines the dependencies between jobs in a dependent job net when jobs must be executed in a specific order.

OPERATOR: This statement transmits any desired message to the operator.

PAUSE: This statement can be used to temporarily halt an input reader during system checkout and test.

PROCESS: This defines the name or series of names of dynamic support program(s) (DSP) to be used with the job specified on the JOB statements. JES3 DSPs are included in the DSP dictionary distributed with JES3; if user job processing services are added to JES3, the system programmer must add the DSP names to the dictionary. This statement causes JES3 to bypass its standard job flow such as job execution or output processing. Any job that includes PROCESS statements receives only the JES3 processing specified on the PROCESS statements, except that which JES3 must perform.

USER EXITS

Many user exits are provided for the system programmer's use in major functional areas of JES3. The basic intent is to provide exits to minimize the need for user modifications to the system. The following list summarizes user exits available with JES3:

- Input service
  - Initialization
  - JOB statement accounting information analysis
  - Resolution for conflicting processor types
  - Standard scheduler elements respecification
  - DJC device requests
  - Continued processing based on control block analysis
- Interpreter service
  - Internal text handling
  - Nonlocatable procedure decisions
  - Prescan JCL compatibility decisions
  - Nonlocatable data sets decisions
  - High watermark setup decisions
  - Continued processing based on job status
  - Message handling from other user exits
  - LOCATE response handling
  - Examination of MVS control blocks prior to SWA creation
- Verify
  - Nonstandard tape label handling
- Dynamic Allocation
  - Data set integrity decisions
- JES3 *CALL command
  - Continued processing based on job control block analysis
- TSO support
  - STATUS, CANCEL, or OUTPUT request analysis
- Output service
  - Data set output scheduler element (OSE) analysis
  - Job header page respecification
  - Data set header respecification
  - Forms alignment respecification
  - Job trailer page respecification
- Console service
  - Redefinition of console authority levels
  - Console message handling

USER-WRITTEN DSPs

Support functions of JES3 are implemented by dynamic support programs (DSPs). DSPs are multiprogrammed JES3 system components that are scheduled by the JES3 job segment scheduler (JSS). A DSP may be directly related to the job's execution, such as the reader/interpreter (RI) DSP or MAIN DSP, or they may be a background utility, such as the card-to-tape (CT) DSP. All the resources of JES3 are available to the DSPs.

The user has the option of defining and writing DSPs. When defining or writing a program that is not directly related to job execution, the user should consider the available options:

- Writing the program to execute as a normal OS/MVS job
- Writing the program and entering it as a procedure in SYS1.PROCLIB
- Writing the program to execute as a DSP in JES3 address space

SYSTEM MANAGEMENT FACILITY (SMF)

The MVS system management facility (SMF) provides facilities to collect and record certain accounting information about the activities occurring in any given system. JES3 assists in this process by collecting information about its actions and invoking SMF recording functions to store that data. SMF recording collects data such as times and dates of CPU processing, line starts, line cancelations, and invalid signon attempts. Any use of this data is determined by the installation. In addition, JES3 provides functions related to output limiting and CPU time limiting that involve an SMF interface.

JES3 invokes two SMF exits; IEFUSO and IEFUJP. A list of JES3 SMF records and their function are provided below:

Record type 6—Output Writer
Record type 5—Job Allocation
Record type 26—Job Purge
Record type 43—Subsystem Start
Record type 45—Subsystem Stop
Record type 47—SIGNON/START Line
Record type 48—SIGNOFF/STOP Line
Record type 49—JES3 Integrity

For more information on SMF, refer to *OS/VS2 Systems Programming Library: System Management Facilities (SMF)*.

EXTERNAL WRITER SUPPORT

The output service external writer support allows system output data to be produced and queued for installation-written output writer routines. JES3 subsystem interface routines are used to retrieve the output data from the JES3 queues. For a detailed description of the external writer support, see *OS/VS2 MVS System Programming Library: JES3*, and *OS/VS2 System Programming Library: Job Management.*

Chapter 5. MVS JOB PROCESSING SERVICES USED BY JES3

This section provides a general description of the function and facilities of MVS and how they are used by JES3. These services are invoked by JES3 routines during job processing. Refer to Figure 5-1 for a list of these services.

SUPERVISOR SERVICES

Supervisor services allow JES3 to utilize the MVS CPU resources in the same manner as any application program.

JES3 may run in any of the following MVS dispatching service modes:

- In user storage, under a user task control block (TCB) which is typical for reading SYSIN, writing SYSOUT, and the subsystem interface calls.
- Under a service request block (SRB) which is used in cross-memory communication and I/O processing.
- As a disabled interrupt exit of the I/O supervisor, for I/O processing.
- In JES3 main storage, under a TCB, which is the usual mode for JES3 processing. JES3 has one task under which it dispatches its own work, and several other tasks for executing MVS services which may cause waits.
- Under an interrupt request block (IRB) exit routine scheduled by VTAM when SNA RJP is active.

JES3 uses the following forms of MVS serialization services:

- *Implicit Program Serialization in a Single Task:* JES3 uses this form predominantly, since most JES3 functions are performed by programs running under the main JES3 task.

MVS JOB PROCESSING SERVICES USED BY JES3
Supervisor Services
Catalog Management
I/O Supervisor (IOS)
System Resource Manager (SRM)
VTAM Interface

Figure 5-1. MVS Job Processing Services Used by JES3

- *ENQ/DEQ Macro Instructions:* These are used primarily in the subsystem interface routines, often implicitly, since the caller actually issues the macro instruction.
- *Locking:* JES3 uses both local and common locks for some serialization functions, especially those involving manipulation of control blocks not in JES3 storage.

JES3 uses standard MVS storage management facilities and implements some additional control for certain control blocks (for example, it issues a page-free macro when an entire page of similar control blocks is no longer needed).

JES3 uses standard MVS program management services and adds a usage count scheme to retain frequently used, reusable routines.

CATALOG MANAGEMENT

In managing devices, volumes, and data sets across the complex, JES3 uses catalog management to resolve the details of requests for cataloged data sets. This is done using standard catalog management LOCATE macro instruction requests. However, the following complications result:

- All catalogs may not be accessible from all systems. To resolve this, the JES3 global processor may pass LOCATE requests to the local processor for execution.
- Since JES3 performs preexecution setup, changes to the catalog during job execution (other than those specified in the job's JCL) are not known to JES3 and cause several anomalies in processing. These changes are handled by restrictions on user processing capabilities. Catalog changes not specified in JCL must be executed as separate jobs from those referenced in the catalog step.
- JES3 may need to get involved in the allocation of the catalogs themselves, which results in restrictions of user capabilities.
- Since JES3 performs preexecuting setup, changes to HSM are not reflected in jobs which have already gone through setup. This means that any changes to the list of HSM-managed volumes could cause abnormalities in the processing of the jobs that have been setup.

I/O SUPERVISOR

The I/O supervisor (IOS) may be used in different ways, such as through an access method, or as an I/O driver as a special interface provided by IOS to authorized users. The access methods are:

- *EXCP:* Writer requests to local card punches and console services requests to local consoles.
- *EXCP VR:* The card reader (CR) dynamic support program requests I/O operations to local card readers.
- *RTAM:* Remote Teleprocessing Access Method requests I/O for remote operations.
- *VTAM:* SNA RJP requests I/O operations for SNA RJP terminals.

JES3 also acts as an IOS driver for spool, CTC, local printer support, and BSC RJP line support. Each method uses the STARTIO interface to convey requests to IOS. Upon completion of the I/O request, IOS interfaces to a disabled interrupt exit (DIE) supplied by the IOS driver. This allows the driver to submit a new request to IOS as well as to indicate early completion of the original request.

Another direct use of IOS is as an attention handler. When an unsolicited device end or attention interrupt has been received, IOS schedules the appropriate routine in JES3 to process the interrupt asynchronously.

SYSTEM RESOURCE MANAGER

JES3 has no direct interface with the MVS system resource manager (SRM). JES3 has algorithms which attempt to provide installation control, including some optimizing, over what jobs are running *long-term* in the complex. The SRM, in an independent effort, attempts to provide installation control, including some optimizing, over jobs (and the resources they use) running *short-term* in a single system. These two efforts may coincide or may tend to counteract each other, depending on the skill of those who set up their control parameters and on what jobs actually appear in the complex.

VTAM INTERFACE

JES3 SNA RJP support is provided through a combination of virtual/telecommunications access method (VTAM) and NCP/VS, ACF/VTAM, and ACF/NCP/VS. VTAM is a component of systems network architecture (SNA), an integrated structure that identifies and isolates network functions. VTAM operates with the IBM 3704 and 3705 Communications Controllers to reduce the number of functions performed in the central computer for remote terminals.

Basic services performed by VTAM include:

- Establishing, controlling, and terminating access between JES3 and the terminals.
- Moving data between JES3 and the terminals.
- Permitting JES3 to share communication lines, communications controllers, and telecommunication terminals with other VTAM applications.
- Permitting the telecommunication network to be monitored.
- Permitting the configuration of the telecommunication network to be changed while the network is being used.

Chapter 6. JES3 RECOVERY PROCEDURES AND SERVICE AIDS

JES3 enhances the reliability, availability, and serviceability (RAS) of the MVS environment. Many recovery procedures and service aids are provided with JES3 and should be considered among the reasons for selecting JES3 as the primary job entry subsystem.

RECOVERY PROCEDURES

Recovery from program and hardware failures in the complex MVS environment must minimize the impact on the efficient flow of the work being done. The recovery support provided by JES3 ranges from operator-handled processor and path switching through automatic restart procedures.

Alternate Processor (CPU) Recovery Support

If the JES3 global processor is a System/370 Model 158 MP or Model 168 MP and a failure occurs in one of the processing units, recovery is attempted on the remaining processor. If the CTC adapters providing loosely coupled support to the local processors are not attached to the failing processor, jobs on these local processors will continue executing. Those local processors losing their CTC path to the global processor will quiesce as they require global service. Restarting these local processors might require reconfiguration and either restarting the global processor or invoking dynamic system interchange (DSI).

Alternate Path CTC Support

If a permanent error occurs on a primary CTC path between a global and local processor, JES3 can make use of an alternate path. To do so, there must be two physical CTC paths between the global and local processor, each defined to JES3 during initialization. A path, for example, might be one CTC connection on the global through a switching device to two CTC connections on the local. The operator physically and logically ensures the alternate path when a permanent error occurs. This may include hardware switching and use of the *VARY command for logical system connection.

Alternate path CTC recovery allows JES3 and job execution to continue normally.

Checkpoint Restart Support

Full support of the checkpoint restart facility is provided for jobs that execute on MVS processors in the JES3 environment.

RJP Recovery Capabilities

The remote job processing (RJP) facility in JES3 places emphasis on recovery from error and conditions that require system restarts. SNA and BSC RJP permits analysis and selective termination of a line or work station or an individual function rather than the entire RJP function when a failure occurs.

Hot Start Restart Support

JES3 provides a form of restart capability known as hot start. When JES3 hot start is invoked, jobs in execution on MVS processors will have their execution temporarily suspended when JES3 global services are required and will resume execution when the hot start is complete. This applies only to jobs on MVS processors on which an IPL is not performed during the hot start. A hot start will not require an IPL on any processor if the MVS system remains operational throughout the failure.

Spool I/O Error Recovery

Standard MVS error recovery routines are used when a spool I/O error is detected. If they signal a permanent error condition, the JES3 spool data management error routines are invoked to recover from errors. If recovery is not possible, JES3 spool data management notifies the requesting dynamic support program (DSP) of the error. JES3 spool data management then allows loss of such things as the data set, job, or priority level, as necessary, so that a restart of the global processor is required only in extreme cases. When I/O errors are encountered an I/O error report is generated for system programmer to assist in error recovery.

Failsoft

JES3 failsoft support improves total sytem reliablility by reducing system restart time through automatic job recovery based on installation-supplied or programmer-supplied restart parameters, and by isolating program errors to specific DSP and permitting that DSP to perform recovery procedures. In case of system failure, all output through the last complete job step can be recovered. JES3 reliability may be reduced for those installations with many user modifications and user-written DSPs. Failsoft support minimizes the impact of an abnormal termination that occurs as a result of a DSP program check. At the time of a JES3 failure, the operator receives a message identifying the failure. In addition, detailed information relating to the failure is displayed on the master (MLOG) console.

Dynamic System Interchange

Dynamic system interchange (DSI) provides the capability to assign the global function of JES3 to a capable, active local processor. DSI is used to sustain the operation of the JES3 complex when a long term global processor (i.e., hardware) failure occurs.

The local processor assuming the global function must have channel-to-channel paths to all other local and ASP main processors in the complex. Any processors for which no path exists cannot be supported by the new global processor.

Hardware switching of global devices to the new global processor is necessary to allow continued operation of such global functions as RJP, console service, output service, and callable DSPs. These global devices are defined at initializations for all local processors that may, if necessary, assume the global function.

DSI is invoked by an operator command on the processor that is to assume the global function.

SERVICE AIDS

JES3 service aids are programs to help the system programmer and IBM representatives to test for, diagnose, and correct failures. One service aid, the ASP-to-JES3 migration aid, is provided to help in the transition from ASP to JES3.

ASP-to-JES3 Migration Aid

The ASP-to-JES3 migration aid available with ASP Version 3.2 allows an ASP main processor to access a global JES3 MVS processor. It allows production testing of a JES3 system while the balance of the work is handled by the ASP system. When a job terminates, output can be printed by the JES3 global processor or returned to the ASP main processor.

The migration aid consists of two callable DSPs. One executes under ASP Version 3.2 on an existing ASP main processor and the other executes under JES3 on the global processor. CTC support routines are also provided. Each DSP communicates with the opposite processor by a common CTC device. The migration aid permits the operator on the ASP system to select jobs to be routed to the JES3 system based on class, group, point of origin, user-specified parameter, or exit routine. The jobs are routed to JES3 for input processing, execution, and output processing; or they may be routed for execution only and returned to the ASP system for output processing.

In addition, a queue dump facility allows jobs in JES3 input and output queues to be transmitted to the ASP system.

ASP Main Simulator

The ASP main simulator program is used for ASP real main system checkout. It allows jobs to be processed on ASP main processors without need for a real system to be attached.

Console Test

The console test (CNT) program allows simultaneous online testing of as many as five JES3 consoles. It is designed primarily as a mechanical test for typewriter-like consoles but may be used to issue test messages to any JES3 console. Test messages are issued directly to a specified console and ignore the switched status of the console. The operator may call the CNT program. After the program is loaded, a message is issued to the calling console indicating that the test facility is operational. The operator then initiates testing of the console by issuing a message that specifies the test console and any desired parameters. The operator can specify the test message, or allow the program to print a standard message. The operator can also control the number of times the test message is issued.

Control Block Print

The control block print (CBPRINT) DSP, invoked using JES3 control statements included in the job stream, causes output service to print out selected JES3 and/or MVS control blocks at any stage in the processing of a job.

Display Dependent Job Control Tables

The display dependent job control (DISPDJC) program is a callable DSP designed to print a report on the status of a dependent job network on a high-speed printer. The report gives information concerning the network, including identification, job count, and the number of jobs completed. In addition, the name and status of each job in the network are listed with information concerning dependencies on other jobs. Dependent job control is described in Chapter 3, "JES3 Services".

Display JES3 Job Queue Status

The display JES3 job queue status (DISPLAY) callable DSP creates a data set for output service containing the status of a single job or of all jobs in the JES3 job queue.

Display Selected Areas of Storage

The DC program is a callable DSP which offers a means to inspect and modify selected areas of storage or JES3 tables on the operator console, incept program flow during execution at a desired location, or to print output in a SYSOUT data set through output service. The areas displayed include JES3 control blocks and other job-related information. The output format is the same as in a JES3 abend dump. This program is primarily a debugging tool for the system programmer.

Event Trace Facility

The event trace facility is available to all JES3 functions and provides diagnostic information to the system programmer in the event of a JES3 system failure. This information includes the trace identifier, module identifier, time of day, and register information at previously selected points in the execution of the job. The JES3 operator may dynamically dump all or selected trace entries to an operator console. The trace facility may be turned on or off by operator command.

Interpreter Debug Facility

The interpreter debug (DEBUG) facility, a function of the reader/interpreter or converter/interpreter, uses output service to print selected JES3 control blocks. It shows the order in which JES3 control blocks are built and modified as OS or VS control blocks are read.

JES3 Abend Dumps

Through abend dumps, selected MVS and JES3 control blocks and areas of storage can be formatted and printed if a JES3 failure occurs.

JCL Test Facility

The JCL test (JCLTEST) facility checks for errors in JCL. No devices are set up, and the job is not processed. This facility is invoked with an EXEC statement.

Job Setup Table Test

The job setup table test (JSTTEST) facility allows the user to obtain a formatted printout of the job summary table (JST) created by an interpreter DSP. JSTTEST is invoked using an EXEC statement. JSTTEST prevents the job from being scheduled for execution. After the user has examined the JST, he may remove the EXEC statement specifying JSTTEST and rerun the job.

RJP Line Snap Facility

The RJP line snap facility allows a user to generate BSC RJP logic traces on the message log console and to generate snap dumps of RJP information for debugging.

Storage Dump on Initialization Error

By using the INTDEBUG control statement, a storage dump can be produced following an error message caused by an error during initialization.

SNA RJP VTAM Debugging Aid

SNA RJP uses the MVS generalized trace facility (GTF) to trace I/O, SVC, PCI, and external interruptions, and for the dispatching of tasks in the operating system as well as in VTAM. In addition, GTF is used to record the VTAM trace data. The VTAM traces may be started or stopped at any time, provided that GTF is active. The PRDMP utility is used to print GTF information. PRDMP can be used to print only VTAM information. Refer to *VTAM Debugging Guide* for more information.

CTC CCW Trace Facility

A facility exists for tracing CCW command codes issued to a CTC. This CCW trace facility is present in three forms:

- Trace to SYSMSG: This method traces all CCW command codes issued to the CTC from a main processor.
- Trace to CTC/MPC: This method records the 16 entry wraparound trace table entries received by a sense command.
- Subset Trace to CTC/MPF: This method records the wraparound trace table entries that result in the JES3 address space being posted.

Page of GC28-0607-2
Revised September 30, 1978
By TNL GN25-0167

Chapter 7. PLANNING CONSIDERATIONS

JES3, as the primary job entry subsystem, provides many features and functions designed to allow maximum efficiency for a wide range of data processing applications. Each user is unique. The decision to install JES3 must be accompanied by a thorough planning process. Such considerations as hardware delivery, manpower requirements, education requirements, and current and planned operating systems (such as OS/MVT, SVS, and MVS) must all be carefully coordinated.

JES3 provides many advantages to the user, but by its very nature is a complex system, and as such, imposes some liabilities during its initial installation. The installation of JES3 requires close involvement, and requires a commitment of all those involved to make the necessary changes and provide the resources necessary to utilize the full facilities of the system.

Multiprocessor or prospective multiprocessor users who are well along in planning the use of MVS are encouraged to establish an MVS installation using a basic, unmodified JES3 subsystem. User-written modifications other than exists or DSPs inhibit application of service and migration to new releases.

Refer to the *OS/VS2 Conversion Notebook* for specific information directed to current ASP users.

SYSTEM GENERATION

JES3 is a component of MVS and can be ordered separately. It consists of source libraries and object libraries containing assembled JES3 modules suitable for link editing. JES3 generation consists of loading object modules and macro libraries from the distribution libraries into the appropriate system libraries. After the first system generation using the IBM-supplied starter system, an existing OS/VS2 system control program can be used for subsequent system generations.

In addition to generating JES3, one or more remote terminal processor (RTP) programs may also be generated. The process of generating RTPs is called RMTGEN and is performed in the same manner as described for JES2. RMTGEN is described in *OS/VS2 MVS System Programming Library: JES3.* All other OS/VS2 system generation information can be found in *OS/VS2 System Programming Library: System Generation Reference.*

JES3 System Generation Macro Considerations

During the first stage (Stage I) of system generation, macro instructions are used to tailor the new MVS system. The following macro instructions have special significance when generating a JES3 system:

JES Macro. If the system is to use JES3 as the primary job entry subsystem, a MVS system directive is provided to aid in the installation of JES3. The JES macro instruction creates the following:

- A starter-level JES3 initialization deck
- A starter-level procedure for invoking JES3
- A Stage II procedure that copies JES3 modules to the appropriate system libraries

The initialization data stream created may contain user-specified values or may assume default values. The following device information and assumed default values are contained in the JES3 macro instruction:

- Reader (RDR): 00C
- Printer (PRT): 00E, 1403, PN (print train)
- Punch (PUN): 00D
- Console (CNS): 01F, 3215

All other JES3 devices must be specified on the JES3 macro instruction.

SCHEDULR Macro. A JES3 system generation requires that the PRISUB parameter on the SCHEDULR macro instruction be coded to reflect the name of the procedure given to JES3 by the JES macro instruction.

CONSOLE Macro. To support MCS and allow for total flexibility of JES3 consoles, every JES3 console and/or potential console should be generated as devices on each of the processors in a JES3 complex. The TYPE=JES parameter may be specified with the CONSOLE macro to correctly generate JES3 consoles.

DATASET Macro. New JES3 system data sets must be defined and allocated using the DATASET macro.

IODEVICE Macro. The CTC adapters connecting the global processor and the other local and ASP main processors must be defined as a device using the UNIT=CTC parameter with the IODEVICE macro.

PHYSICAL PLANNING

JES3 provides great flexibility in the location of equipment in a machine room. By using additional operator consoles, JES3 installations can physically separate the operational functions (card I/O, printing, tape setup) across multiple systems to locate them in areas more convenient to the local work flow. The card readers, punches, and printers may be located in the job dispatching area where programs are submitted for execution and output is returned. The mountable I/O units may be placed in an area that is convenient to the tape and disk library. In addition, an operator console can be placed at the tape and disk librarian's desk to issue library volume requests. The processing units may then be placed in some other area that is free of the congestion typical of the peripheral units.

Chapter 8. JES3 SYSTEM CONFIGURATION OPTIONS

An OS/VS2 system with JES3 requires a minimum of 1M bytes of main storage for local processors, and a minimum of 3M bytes for global processors. JES3 supports System/370 Model 145, Model 155II, Model 158 (including MP models), Model 165II, and Model 168 (including MP models).

The functional workload of the system, in conjunction with a minimal hardware configuration, may limit the number of user address spaces available for concurrent operation.

For SNA RJP users, JES3 must be applied to OS/VS2 MVS Release 3.7, or a subsequent functionally equivalent release, which can simultaneously support VTAM and NCP. See *Introduction to VTAM* for additional information on the virtual telecommunications access method (VTAM).

MINIMUM CONFIGURATION

The minimum configuration for JES3 is described below:

- One System/370 processing unit and real storage. On the Model 145, the Clock Comparator and CPU Timer feature (2001), and the Advanced Control Program Support feature (1001) are required.
- Storage capacity of one megabyte. (Although this may be satisfactory for a JES3 local processor, it is recommended that the JES3 global processor have a minimum of 3 megabytes of main storage.)
- One multiplexer channel.
- One selector or block multiplexer channel.
- Three 3330/3340-type disk storage devices.
- One card reader.
- One printer.
- One hard-copy console, or one display console with hard-copy log.
- One 9-track tape drive for all distributions of program libraries and updates.
- One additional tape drive is recommended for the output of the high-speed standalone dump program (AMDSADMP). The 9-track tape drive for the distributions may be used for the dump.

SPOOL CONFIGURATION

JES3 uses a system data set on each volume identified as a spool volume to store all job input, job output, JES3 control blocks, and system data such as the job journal. During JES3 initialization a specified ddname identifies the direct-access storage device on which the spool data sets reside. JES3 must format the associated volume space. Devices and control units supported as JES3 queue devices are discussed later in this chapter under "I/O Device Configuration."

The maximum number of 3330, 3340 or 3350 disk data sets constituting the spool data base is 31 or less, depending on the number of available cylinders and the values selected for the JES3 buffer size. These may be spread across any combination of multiple channels, multiple controllers, and disk volumes. Usually only

one data set is allocated per volume. Each data set must be allocated as an integral and contiguous number of cylinders. Any secondary cylinders are ignored. Once a spool data set is allocated to JES3 at initialization, the volume may not be varied offline. The number of data sets allocated to JES3 may be reduced only during a cold start of the JES3 system, but it may be increased for either a cold or warm start. If a data set is added, it must already be formatted according to JES3 requirements, or the JES3 system must be requested to format it. Once a data set has been allocated to JES3, its physical location (that is, its extent), disk volume, and record size are fixed until the next cold start, at which time they may be changed.

CONSOLE CONFIGURATION

JES3 consoles are physically connected only to the global processor but are capable of exercising control over all processors in the system. The multiple console support (MCS) consoles may be physically connected to global or local processors, but they control only the processors to which they are connected. Figure 8-1 lists MCS consoles.

MCS Console*	Notes
• IBM System/370 Model 158 Console (See notes 5 and 6) • IBM 1403 and 1448-N1 printer (see note 1) • IBM 2150/1052-7 Printer • IBM 2260 Display (see notes 3 and 5) • IBM 2540 and 2520 (see note 1) • IBM 2740-1 Terminal • IBM 3066 (see note 5) • IBM 3505 (see note 1) • IBM 3210, and 3211 (see note 1) • IBM 3215, 3525 (see note 1) • IBM 3277 (see notes 4 & 5) • 3284 (see notes 4 & 5) • 3213 (see notes 1 & 6) • 3286 (see notes 4 & 5) • 3288-2 (as a 3286-2) (see notes 4 & 5) • 3767 (as a 2740-1) • 2250 (see notes 2 & 5) • 3036 System Console (see note 7)	1. A composite console must consist of a printer-keyboard or a card reader and printer to simulate the actions of a printer-keyboard. MCS allows output-only consoles as secondary consoles. 2. 2250 Models 1 and 3 3. 2260 Model 1 on 2848 Model 3 (local attachment) 4. The 3277 Model 1, 3284 Model 1 and 3286 Model 1 attach via a 3272 Model 1 or 2. The 3277 Model 2, 3284 Model 2, 3286 Model 2, and 3288 Model 2 via a 3272 Model 2 only. 5. DIDOCS supported. 6. 158 Display Console is supported in printer-keyboard or display mode. When in printer-keyboard mode, a 3213 is required. When used in display mode, it is suggested that addresses 014 or 016 be used for the console and 015 or 017 for the 3213. 7. Supported as a 3277-2 Display Station.

*MCS consoles provide backup console service for JES3 consoles that fail.

Figure 8-1. MCS Console Configuration Devices

To send system commands to and receive response from a local processor at a JES3 console, the JES3 console must be associated with an MCS console on each processor. The association is accomplished via the UNIT parameter on the CONSOLE initialization statement.

In a JES3 configuration, consoles are defined as follows:

- Devices that have been defined during JES3 initialization as JES3 console devices
- Devices that have been defined during system generation as MCS master consoles and as MCS secondary consoles
- Dummy consoles specified as TYPE=JES during system generation

All JES3 console devices should be defined at system generation as MCS secondary consoles to permit MCS to switch the master console function on the global processor in the event of a master console failure and to facilitate dynamic system interchange (DSI). A secondary console is any console other than the master console; it handles one or more functions assigned to it.

In addition to support for consoles attached to the global processor, JES3 provides remote console support for:

- Card readers
- Printer-type devices attached to nonprogrammable BSC RJP work stations.
- System console-type devices attached to programmable BSC and SNA RJP work stations.
- Card readers and printer-type devices attached to SNA RJP work stations.

Figure 8-2 lists JES3 console configuration devices.

Console	Required Features	Optional Features	Notes
IBM 2740 Communication Terminal, Model 1 (See Note 1 and 2) Attached to either: • IBM 2701 Data Adapter Unit (See Note 3) or • IBM 2702 Transmission Control (See Note 3) or • IBM 2703 Transmission Control (See Note 3) or • IBM 3704 Communications Controller—Emulation Mode (See Note 3) or • IBM 3705 Communications Controller—Emulation Mode (See Note 3)	• 4790 IBM Line Adapter • 9104 Character Spacing—10 char/inch • 9435, 9436 Line Feeding • 9592 PTTC/EBCD Printing Element • 9700 System Application • 4636 IBM Line Adapter (See Note 4) • 4640 IBM Terminal Adapter Type I (See Note 4) • 9581 Speed Selection (For 4640) • 4612 IBM Line Adapter (See Note 5) • 4615 IBM Terminal Control Type I • 9684 Speed Selection (for 4615) • 9696 Terminal Control Base • 4619 IBM Terminal Control Base • 4688 IBM Line Set (See Note 6) • 4696 IBM Terminal Control—Type I • 4878 Line Speed Option • 7505 Start Stop Base Type I	• 6114 Record Checking • 3815 Expanded Capability • 3855 Expanded Capability • 7955 31-Line Expansion • 1440 Base Expansion	1. The following features *may not* be attached: 1313 Automatic EOB 3255 Dial Up 7479 Station Control 8028 Transmit Control 2. This console must be attached by a dedicated line to a 2701, 2702, 2703, 3704, or 3705 3. Additional features, such as adapters, speed selections, and terminal controls may be included if they are not used with the auxiliary portion of JES3. 4. One per console. 5. One per line. 6. One for eight consoles.

Figure 8-2. JES3 Console Configuration Devices (Part 1 of 4)

Console	Required Features	Optional Features	Notes
IBM 2260 Display Station Model 1 (See Note 1) Attached to: IBM 2848 Display Control, Model 3 (See Notes 2 and 4)	• 4766 Alphameric Keyboard • 4787 Line Addressing • 9011 Channel Adapter • Specify System Attachment	• 9430 Long Cable Attachment • 3858, 3859 Expansion Unit • 5340, 5341 Non-destructive cursor (and adapter) • 7928 Printer adapter (See Note 3)	1. Local mode 2. IBM Terminal Adapter Type III, 4656 and 4657 *may not* be attached. 3. Required for 1053 Model 4. 4. The following features *may not* be attached: 4656 and 4657 IBM Terminal Adapter Type III
IBM 1053 Printer Model Model 4 (See Note)	• 1006 Accelerated Carrier Return		This device is available when the IBM 2848 Display Control, Model 3 is ordered
IBM 1443 Printer Mode N1			
IBM 1403 Printer Model 2, 3, 7, or N1	• 1416 Interchangeable Train Cartridge (See Note)		Model 3 or N1.
IBM 3211 Printer	• 3216 Interchangeable Train Cartridge	• 5554 150 Print Positions	
IBM 1052 Printer/Keyboard Model 7(See Note 1) Attached to: IBM 2150 Console	• Attached to 1052 Model 7	• 5475, 5476 Operator Control Panels	1. Direct or remote attachment.
IBM 2250 Display Unit Model 1	• 1245 Alphameric Keyboard • 1498, 1499 Buffer • 1880 Character Generator	• 1002 Absolute Vectors and Control • 4485 Graphic Design • 4785 Light pen • 5475, 5476 Operator Control Panel • 5855 Programmer Function Key-board	

Figure 8-2. JES3 Console Configuration Devices (Part 2 of 4)

Console	Required Features	Optional Features	Notes
IBM 3060 System Console (See Note 1)	• 5476 Operator Control Panel (second)		1. For System/370 or System/360 Model 195 that has switched to a JES3 system.
IBM 3066 System Console (See Note 1)			1. For System/370 Model 165 or 168.
IBM System/360 Model 85 Operator Console	• 5450 (See Note 1)		1. For System/360 that has been switched to a JES3 system.
IBM 3210 Console Printer/ Keyboard, Models 1 and 2			
IBM 3215 Console Printer/ Keyboard			
IBM 3277 Display Station Model 2 (See Note 1) Attached to: IBM 3272 Control Unit Model 2 (See Note 2)	• EBCDIC or Operator Keyboard	• All other features	1. This device must be attached to an IBM 3272. 2. Local attachment
IBM 3284 Printer, Model 2	• 3272 Model 2		
IBM 3288 Printer, Model 2	• 3272 Model 2		
IBM 3286 Printer, Model 2	• 3272 Model 2		
IBM 3767 Communications Terminals Model 1 (See Note 1 and 2)	• 3719 EIA Interface • 7111 Start-Stop Feature 2749-1 • 9391 Keyboard-EBCDIC • 9402 Half-duplex Line Facility • 9540 Start-Stop 300 BPS	• All other features	1. Supported as a 2740 Model 1. The EOB key is restricted on 2740 consoles. The presence of the EOB key on the 3767 does not prevent its use as a JES3 console; however, RPQ RF 7171 is available to prevent accidental depression of the EOB key. 2. The 3767 requires special features on the 3704/5 (it cannot be attached to a 2701, 2702, or 2703). The 3704/5 must have feature 4716-1F line set.
IBM 7412 Printer/Keyboard Model 1 (See Note)			RPQ similar to 2150 but uses a 3215-type printer.
IBM System/370 Model 158 Operator's Console			

Figure 8-2. JES3 Console Configuration Devices (Part 3 of 4)

Console	Required Features	Optional Features	Notes
IBM 3056 Remote System Console (See Note)			Attached to System/370 Model 158
IBM 3790 Communication System (See Note)			Both local channel and remote attachment
IBM 3036 System Console (See Note)			Supported as a 3277 Display Station

Figure 8-2. JES3 Console Configuration Devices (Part 4 of 4)

I/O DEVICE CONFIGURATION

I/O devices are card readers, printers, card punches, tape units, direct-access devices, and other units that are attached to JES3 global processor and used for reading jobs and writing output. The internal reader and external writer may also be used as I/O devices.

During JES3 initialization, the system programmer identifies all devices that are managed by JES3. The operator can dynamically reconfigure and otherwise communicate with each JES3 device by name. Other local and ASP main processors attached to the global processor by a channel-to-channel (CTC) adapter must also be identified during initialization. The global processor, in addition to being managed by JES3, usually serves as a processor on which jobs execute.

REMOTE DEVICE CONFIGURATION

Remote JES3 devices are those terminal devices and CPUs (called work stations) that are attached to the global processor by telecommunication lines for submitting jobs to and receiving output from the JES3 installation. This function, called remote job processing (RJP), is achieved by use of control units that interface with remote binary synchronous communications (BSC) work stations or SNA RJP work stations. Remote card readers, card punches, and printers are supported in much the same manner as local devices. Figure 8-3 lists I/O and remote configuration devices.

BSC REMOTE WORK STATIONS WITH MULTI-LEAVING SUPPORT

JES3 RJP is designed to support the remote terminal processing (RTP) programs. These are presently available for systems operating in binary synchronous communication transmission mode. MULTI-LEAVING support is fully synchronized two-directional transmission of a variable number of data streams between terminals and a processor using BSC. JES3 RJP does not support the HASP II STR terminal packages. Care must be exercised in generating the RTP programs (called on RMT generation) to ensure compatibility in specifications of devices and buffer sizes with those specified to JES3 at initialization. Figure 8-4 lists BSC remote programmable work stations with MULTI-LEAVING support.

Direct-Access Storage Devices	Direct-Access Storage Control Units	Notes
IBM 2314 Disk Direct Access Storage Facility (See Note 1) IBM 2319 Disk Storage (See Note 1) IBM 3330 Disk Storage, Models 1, 2 and 11 IBM 3333 Disk Storage and Control, Models I and II IBM 3340 Disk Storage, Models A2, B1, and B2 IBM 3350 Disk Storage Models A2, A2F, B2, and B2F IBM 3850 Mass Storage System Models A1, A2, A3, A4, B1, B2, B3, and B4 (See Note 1)	• IBM 2844 Auxiliary Storage Control • IBM 3830 Storage Control Model 2 (See Note 2 and 5) • IBM 3345 Storage and Control Frame Models 3, 4, and 5 (See Note 3) • Integrated Storage Controls (See Note 4)	1. This cannot be used as a JES3 queue device. 2. Including two-channel switch and two-channel switch, additional. 3. For System/370 Model 145 only. 4. For System/370 Model 158 and 168 only. 5. The string switch facility, which allows manual or dynamic switching between 3830 Model's, integrated file adapters or integrated storage control units, is supported by JES3.
Magnetic Tape Devices/Control Unit **Devices** IBM 2401 Magnetic Tape Unit IBM 2420 Magnetic Tape Unit IBM 2495 Tape Cartridge Reader IBM 3410/3411 Magnetic Tape Unit and Control, (See Note 1) IBM 3420 Magnetic Tape Unit IBM 3803-2/3420 Models 4, 6, and 8 **Control Unit** IBM 2816 Switching Unit Model 1	**Printers/Control Units** **Printers** • IBM 1403 Printer Models 2, 7, and N1 • IBM 1443 Printer Model N1 • IBM 3211 Printer • IBM 3800 Printing Subsystem **Printer Control Units** • IBM 2821 Printer Control Unit, Models 1, 2, 3, and 5 • IBM 3811 Printer Control Unit	1. For System/370 Model 145, 155II, and 158 only.
Card Readers and Punches IBM 2501 Card Reader Models B1 and B2 IBM 2540 Card Reader Punch IBM 3505 Card Reader Models B1 and B2 IBM 3525 Card Punch	**Diskette Device** • IBM 3540 Diskette Drive (See Note 1)	1. Supported as a SYSIN or SYSOUT device. The 3540 reader utility program and the external writer program provide the actual interfaces to the 3540 device.
Remote Work Stations Any Terminal device or CPU that is attached to the global processor by telecommunication lines for submitting jobs to and receiving output from the JES3 installation. This function, called remote job processing (RJP), is achieved by use of control units that interface with remote binary synchronous communications (BSC) work stations, or SNA RJP work stations.	**Remote Work Station Control Units** (See Note 1) • IBM 3704 Communications Controller (Emulator Mode) • IBM 3705 Communications Controller (Emulator Mode) • IBM 2701 Data Adapter Unit • IBM 2703 Transmission Control Unit	1. The following optional features are supported: • EBCDIC Transparency. • Dual Code (with EBCDIC as either code). • Dual Communications Interface.

Figure 8-3. I/O and Remote Configuration Devices

Workstation	Requirements	Options	Notes
System/360 and System/370 (See Note 1) For Model 25 and Models 115 through 168 MP (See Note 2) IBM 3031, 3032, and 3033 processors	• For system/360 8K minimum main storage • 2074 EBCDIC Binary Synchronous Communications Adapter • 1052 Compatibility feature • Communications control unit (See Note 3) • Card reader • Communication Lines (See Note 4) • Operator console (See Note 5) • Remote I/O devices	**Adapters** • IBM 2701, 2703 adapter or 3704 or 3750 control unit **Card readers** • IBM 2540, 2501, 2520, or 1442 card readers or punches **Remote devices** • IBM 1442, 2501, 2520, 2540 readers or punches • IBM 1403, 1443, 3211, and 1052 printers (See Note 6)	1. To obtain maximum performance with more than four simultaneously active unit record devices, the user should have at least 12K of storage and appropriate communication and CPU facilities. 2. The System/370 Model 115 and 125 uses the same remote generation as the System/360. 3. Or equivalent for System/370 models 25 and 135. 4. Lines may be switched or nonswitched of any speed. 5. The standard operator console is supported as a JES3 limited or full function remote operator console. 6. A maximum of seven readers, seven printers, and/or seven punches are used by RJP on each workstation, but only 15 functions may occur simultaneously (seven input and eight output) in addition to console operations.
System/360 Model 20	• Minimum 8K main storage • 2074 EBCDIC Binary Synchronous Communications Adapter • Card reader • Remote I/O devices (See Note 1) • Communication Lines (See Note 2)	• IBM 2501, 2520, or 2560 reader/punch • IBM 1403, 2203, 1442, 2250, 2560, and 2152 printer • 4100 Full Transparency • 2152 Printer/Keyboard. (See Note 3)	1. In any hardware combination. 2. Lines may be switched or non-switched of any speed. It is recommended that a submodel 5 be used in conjunction with high-speed communications lines (19,200 bps or greater) for maximum performance. 3. The 2152 cannot be used on other than a submodel 5 if a communication line of 19,200 bps or greater is used.
2922 Programmable Terminal (See Note 1)	Standard 2922 input and output devices		1. The 2922 uses the same remote generation as the System/360 Model 20.
1130 Computing System	• 8K words of storage minimum. • 7690 Synchronous Communications Adapter • Any card reader (See Note 1) • Communication line (See Note 2) • Console printer/ keyboard (See Note 3)	• All standards readers, printers, and punches available for the 1130 system.	1. Including multiple readers and punches. 2. Lines may be switched or nonswitched of any speed. The high-speed communication line RPQ feature is not supported. 3. Supported as a limited-function or full-function remote operator console.

Figure 8-4. BSC Remote Programmable Work Stations with MULTI-LEAVING Support (Part 1 of 2)

Workstation	Requirements	Options	Notes
System/3 (See Note 7) System/7 (See Note 8) System/32 (See Note 8)	• 5410 Central Processing Unit (See Note 1) • 5424 Multi-function Card Unit (See Note 1) • 5203 Printer (See Note 1) • 2074 EBCDIC Binary Synchronous Communications Adapter	• 1442 Card Reach Punch (See Note 2) • 5471 Printer Keyboard (See Note 6) • 5475 Keyboard • 8639 Universal Character Set for 5203 Printer • 5558 or 5560 Additional Print Positions for 5203 Printer • 1315 Text transparency • Any communication line available for System/3 • 24 or 36 extra print positions on 5203 Printer (See note 3) • UCS and PN train on 5203 Printer (See Note 4) • Text transparency (See Note 5)	1. Any model is supported. 2. RPQ 843175 on System/3 5410 and RPQ 841205 on 1442. 3. To provide for standard OS print line. 4. To provide for standard OS character set. 5. To allow full use of the EBCDIC character set. 6. Optionally, as a remote operator console. 7. The following features *are not* supported: 9482 Multi-point Network Attachment 9061 USACII Transmission Code 7477 Station Selection (Any features not specifically listed as *not supported* may be attached to the System/3 but will not be supported by JES3.) 8. Supported as an IBM System/3.

Figure 8-4. BSC Remote Programmable Work Stations MULTI-LEAVING Support (Part 2 of 2)

BSC REMOTE WORK STATIONS WITHOUT MULTI-LEAVING SUPPORT

Certain devices are supported by JES3 RJP as remote, non-MULTI-LEAVING work stations. MULTI-LEAVING support offers two-directional transmission of multiple data streams between a terminal and a processor; non-MULTI-LEAVING support offers two-directional transmission of a single data stream between a terminal and a processor. In each case, card reader and printer-type devices may be initialized by JES3 as operator consoles. Input commands are entered at the card reader and responses are received on the printer device. Figure 8-5 lists BSC remote nonprogrammable work stations without MULTI-LEAVING support.

SNA REMOTE WORK STATIONS

The following devices are supported by JES3 RJP as systems network architecture remote job processing (SNA RJP) remote programmable work stations. SNA RJP offers SDLC line protocols for transmission to the host through VTAM. Figure 8-6 lists the SNA RJP work stations that JES3 supports.

Workstation	Requirements	Options	Notes
2780 Data Transmission Terminal (See Note 1)	• EBCDIC Transmission Code	• EBCDIC transparency. (See Note 2) • 5010 Multiple Record feature. (See Note 3) • 5802 120-character print line feature. • 5821 144-character print line feature. • 5800 Printer Horizontal Format Control. (See Note 4) • 7705 Synchronous Clock. • 1340 Auto Answer. • 1350 Auto-Turnaround. • 8750 Terminal Identification. (See Note 5)	1. Multi point Line Control feature is *not* supported. If installed, improper operation may occur. 2. This feature is required if the full EBCDIC character set is to be transmitted. 3. This feature is recommended to improve terminal performance, particularly on a switched, 2000-band or faster line. 4. This feature is used by RJP to provide an imbedded bank-compression capability. JES3 RJP's use of horizontal tabs, if specified at initialization, is completely automatic and is totally transparent to the programmer. This feature can significantly improve terminal print performance. 5. If the terminal identification feature is present, the ID sequence is read, but no action is performed.
2770 Data Communication System (See Note 1)	• 2772 Control Unit • 2074 EBCDIC feature	• 1490 Buffer Expansion. (See Note 2) • 1491 Buffer Expansion. (See Note 3) • 3650 EBCDIC transparency. (See Note 4) • 4610 Terminal Identification. (See Note 5) • 4690 Keyboard Correction. • 5890 Horizontal Format Contro, with prerequisite feature. • 6310 Security Identification. (See Note 5) • 6555 Space Compression/ Expansion. • 7705 Synchronous Clock. • 7950 Transmit Receive Monitor Print. • 2213 Model 2 Printer. • 2203 Model A1 or A2 Printer. • 2502 Model A1 or A2 Card Reader. • 545 Output Punch.	1. The 5010 Multi-Point Data Line Control feature is incompatible with JES3 RJP support. All features not specifically prohibited may be attached to the 2772 but are not supported by JES3 RJP. 2. Recommended for optimum performance. 3. For additional expansion. 4. This feature is required if OS object decks are to be transmitted or punched. 5. If this feature is present, the ID sequence is read, but no action is taken.

Figure 8-5. BSC Remote Nonprogrammable Work Stations without MULTI-LEAVING Support (Part 1 of 2)

Workstation	Requirements	Options	Notes
3740 Data Entry System (See Note 1)	• 3741 Model 2 or 4 or • 3747 Terminal with 1660 BSC adapter feature	• 7850 Terminal Identification (See Note 2)	1. The 1680 or 1685 expanded communication features are not supported. 2. If the feature is present, the ID sequence is read, but no action is performed.
3770 Data Communication System (See Note 1)	• BSC capability • I/O devices • Work station console	• 3771 through 3775 defined as 2770. (See Note 2) • 3776, 3777 Model 1 defined as 3780. (See Note 2) • 3777 Model 2 defined as System/360 Model 20. Submodel 5 (See Note 2) • Console Printer defined as 2213. • 3784 Line Printer on 3774 defined as 2203. • 3521 card punch defined as 545. • Card Reader defined as 2502-A1 A-2. (See Note 3)	1. The 3770 is supported by the same System/370 programs that support the 2770 Data Comm Communication systems. In BSC mode, RJP operational characteristics of the 3770 are similar to those of the 2770. 2. Defined in JES3 initialization deck as 2770 devices. 3. The 2502-A1 and A2 card reader; 3501 card reader, or the 3521 card punch with read features is defined as a 2770 2502 model A1 or A2 card reader.
3780 Data Communications Terminal (See Note 1)	• EBCDIC transmission code • Space Compression/ Expansion feature	• 3601 EBCDIC transparency (See Note 2) • 5701 Additional Print Position feature. • 4650 Keyboard. • 7651 Switched network control. (See Note 3) • 9350 Terminal Identification. (See Note 4) • 3781 Card Punch (See Note 5) • 2821 Model 1, 5, or 6 Reader and Punch control units	1. The 5010 Multi-Point Data Link Control feature is *not* supported and causes improper operation if installed. 2. This feature is required if the full EBCDIC character set is to be transmitted. 3. Do *not* specify a 9350 terminal identification feature with this feature. 4. If this feature is present, the ID sequence is read, but no verification is performed. 5. Requires the 1601 component selection features for JES3 support.
Office System 6 (See Notes 1 & 2)	• BSC capability • EBCDIC/ASCII transmission code		1. The Office System 6 is supported by the same System/370 programs that support the 2770 Data Communication Systems. 2. Defined in JES3 initialization deck as 2770 devices.

Figure 8-5. BSC Remote Nonprogrammable Work Stations without MULTI-LEAVING Support (Part 2 of 2)

Workstation	Requirements	Options	Notes
3770 Data Communications System	• I/O devices • Workstation console • Communications controller	• 3771 Models 1, 2 and 3 • 3773 Models 1, 2 and 3 • 3774 P/3775P • 3774 Models 1 and 2 • 3775 Models 1 • 3776 Models 1, 2, 3 and 4 • 3777 Models 1 and 3 • 3784 Line Printer • 3203-3 Printer • 3521 Card Punch • 3501 Card Reader • 2502 Card Reader	
3790 Communica-time System	• Communications controller • I/O devices	• Local and remote channel attachments. • 3784 Line Printer • 3203-3 Printer • 3521 Card Punch • 3501 Card Reader • 2502 Card Reader • 3270 Terminals • 3793 Terminals • 3792 Printer	

Figure 8-6. SNA RJP Work Stations

GLOSSARY OF TERMS AND ABBREVIATIONS

This glossary provides definitions of OS/VS2 and JES3 terms used in this publication. For definitions not included, see *IBM Data Processing Glossary*, GC20,1699.

ASP: Attached support processor.

called job: A job invoked in response to an *CALL command.

channel-to-channel (CTC) adapter: A hardware device that is used to connect two channels on the same or different computing systems.

cold start: The first start after system generation. A cold start invokes the initialization process and may also be required after an unrecoverable failure.

console service: A group of JES3 resident modules which provide communication between the operator and JES3.

converter/interpreter (CI): The job segment that converts and interprets JCL for jobs that execute on MVS processors.

CTC: Channel-to-channel.

DASD: Direct access storage device.

DC: Dump core.

demand select job: A job entered into JES3 via a TSO logon, an MVS MOUNT command, or a started task.

DDR: Dynamic device reconfiguration.

dependent job control (DJC): The organizing of a collection of jobs that must execute in a specific order. DJC manages jobs within a specific job network.

device fencing: Reserving devices for use only by jobs within a specified job group, or jobs within a specific job network.

DJ: Dump job.

DJC: Dependent job control.

DR: Disk reader.

DSI: Dynamic system interchange.

DSP: Dynamic support program.

dynamic allocation: Assignment of system resources to a job which the job is executed rather than before it is executed.

dynamic device reconfiguration (DDR): A facility that allows a demountable volume to be removed, and repositioned if necessary, without abnormally terminating the job or repeating the initial program load procedure.

dynamic support program (DSP): A programmed routine which performs the work defined by a job segment.

dynamic system interchange (DSI): The facility which allows the operator to switch the global processor functions to a local processor in case of a global processor failure.

dynamic writer: An output service function that controls printing or punching of data sets whose characteristics are not assigned to a specific device but are assigned by JES3 to appropriate devices as they become available.

early resource release: The releasing of resources (devices, volumes, and data sets) after they are no longer needed but before job/step termination.

ESTAE: Extended STAE.

explicit setup: The programmer's specification, on a JES3 control statement, of precisely which devices are to be set up.

external writer: A program that supports the ability to write SYSOUT data to devices not supported by JES3.

failsoft: A JES3 recovery procedure which reduces system restart time through automatic job recovery based on installation-supplied or programmer-supplied restart parameters.

FCB: Forms control buffer.

FCT: Function control table.

function control table (FCT): A resident table in JES3 which is used by the multifunction monitor to schedule JES3 functions.

generalized main scheduling (GMS): A set of algorithms that allow the JES3 system programmer to tailor job scheduling and selection to the specific needs of the installation.

global processor: The MVS processor in the JES3 installation in which the JES3 address space manages jobs for all processors in the installation, including itself.

GMS: Generalized main scheduling.

HASP: Houston automatic spool program.

Houston automatic spooling system (HASP): A computer program that provides supplementary job management, data management, and task management functions such as control of job flow, ordering of tasks and spooling.

high watermark setup (HWS): A type of setup which reserves the maximum number of devices of each type needed during any one job step.

hot start: A restart that reinitializes JES3 without allowing changes to the initialization deck. A hot start does not require an IPL. Recovery of all jobs in execution is attempted.

hot start with analysis: A hot start which attempts to identify and delete jobs which prevent JES3 from restarting.

hot writer: An output service program that controls printing or punching of data sets with characteristics that are assigned for processing on a specific device.

HWS: High watermark setup.

IJP: Internal job processing.

initialization (JES): The process which reads the JES3 initialization control statements and creates the tables and control blocks used throughout the JES3 program.

input service: The function that accepts and queues all jobs, except jobs invoked by the *CALL command, entering the JES3 system.

internal reader: A facility that transfers jobs to the JES3 input service function.

interpreter service: The JES3 function that converts JCL statements to internal text and control blocks.

IOS: Input/output supervisor.

IOSB: Input/output service block.

IPL: Initial program load.

JCT: Job control table.

JES: Job entry subsystem.

JES2: A functional extension of the HASP II program that receives jobs into the system and processes all output data produced by the job.

JES3: A functional extension of the ASP program that receives jobs into the system and processes all output data produced by the job.

JES3 job queue: See job control table (JCT).

JES3 spool access method (JSAM): Data management routines that serve JES3 address space requests such as allocation and deallocation of JES3 buffers.

JESTAE: JES3 extended STAE.

JMR: Job management record.

job: One or more units of work. Every job has an entry in the job control table (JCT).

job control table (JCT): A control block which defines the existence of a job and contains data relative to the characteristics of the job.

job management record (JMR): Record which contains a communication area for SMF exits and an information source for SMF records.

job queue element (JQE): A resident table which contains a summary of the information in the job control table (JCT).

job segment: A logical portion of work that JES3 performs on behalf of a job.

job segment scheduler (JSS): A resident function of JES3 which schedules job segments.

job summary table (JST): A chained, single-record file whose FDB is in the resident job queue entries. This table contains the job setup requirements.

JES3 spool access method (JSAM): Data management routines that serve JES3 address space requests such as allocation and deallocation of JES3 buffers.

JQE: Job queue element.

JSAM: JES3 spool access method.

JSS: Job segment scheduler.

JST: Job summary table.

local processor: In a complex of processors under JES3, a processor that executes user's jobs and that can approve global functions in the event of failure of the global processor.

Local start: allows the local processor to be initialized. Initializing information for the local processor is provided by the global processor.

logical storage: The amount of real storage required by a job or a job step to execute efficiently on a processor when running under JES3.

loosely coupled multiprocessing: Two or more computing systems interconnected by channel-to-channel adapter, shared spool devices, and JES3.

main device scheduling (MDS): Controls the set up of I/O devices associated with job execution.

main service: A DSP that schedules problem programs for execution and manages the flow of data across the CTC adapter to and from the global processor.

3850 mass storage system (MSS): A system that extends the virtual storage concept on direct access storage and a user's online data storage capacity to as much as 472 billion characters of information.

MCS: Multiple console support.

MDS: Main device scheduler.

migration: The changing over from an installation's production operating system to an upgraded or entirely new operating system, such as from OS/MVT to OS/VS2.

MSS: Mass storage system.

multifunction monitor (MFM): The dispatcher of all JES3 functions. It is contained in module IATGRCT.

MVS: Multiple virtual storage.

MULTILEAVING line manager: Controls all line activity with remote terminals.

multiple console support (MCS): An optional feature of MVT and OS/VS2 that permits selective message routine of up to 32 operator's consoles.

multiple virtual storage (MVS): A virtual storage facility that allows each user a private address space. MVS is provided at OS/VS2 Release 2 and subsequent releases.

multiprocessing system: A computing system employing two or more interconnected processing units to execute programs simultaneously.

nonstandard job: A job in which //*PROCESS control statements are included in the job's JCL.

normal job: Job submitted via a reader DSP, IJP, RJP, NJP, or from TSO users.

OSE: Output service element.

output service: The function that processes SYSOUT data sets. Processing includes printing, punching, or directing output to an external writer.

preexecution setup: The portion of setup performed by MDS prior to a job entering execution.

Processor: Any processor in the JES3 installation on which jobs can execute. The three types of main processors are (1) global main, (2) local main, and (3) ASP main.

reader/interpreter (RI): The job segment that reads and interprets JCL for jobs that execute on ASP main processors.

remote job processing (RJP): A facility that permits the input, processing, and output of jobs to and from terminals remote from the JES3 installation.

remote terminal access method (RTAM): An access method which provides blocking/deblocking, compression/decompression, and synchronization with the remote terminal in such a way that the DSP need not be concerned with the characteristics of the remote terminal with which it is communicating.

remote terminal processor program (RTP): A self-loading object deck created as a result of an RMT generation. Remote terminal processor programs allow JES3 to communicate with programmable remote work stations.

RI: Reader/interpreter.

RJP: Remote job processing.

RMT: Remote terminal processor program.

resident parameter table (RESPARAM): A table which contains the FCT entries for JES3-permanently resident functions.

RTAM: Remote terminal access method.

RTP: Remote terminal processor.

scheduler element (SE): Job segment which has an entry in the job control table (JCT).

SDLC (synchronous data link control)

SDM: Spool data management.

SE: Scheduler element.

setup: Consists of volume fetching, allocation, mounting, and deallocation.

SMF: System management facility.

SNA: System Network Architecture.

SNA RJP: Systems network architecture remote job processing.

spin data set: An output data set which is processed prior to the termination of the job that created it.

SPOOL (simultaneous peripheral operation on-line)

SSI: Subsystem interface.

STAE: Specify task abnormal exit.

standard job flow: Consists of the scheduler elements which are scheduled by JES3 for every job which has no //*PROCESS statements.

subsystem interface (SSI): A set of programmed routines that allow two-way communication between JES3 address space and another address space.

SVC: Supervisor call.

SVS (single virtual storage)

TSO: Time sharing option.

USAM: User spool access method.

user spool access method (USAM): Data management routines that do not execute in the JES3 address space but provide the subsystem interface for allocation, deallocation, SYSIN/SYSOUT, OPEN, and CLOSE functions of user data sets.

VTAM (virtual telecommunications access method): The process of defining the teleprocessing network to VTAM and modifying IBM-defined VTAM charateristics to suit the needs of the installation. VTAM definition is implemented by the installation with definition statements and macro instructions that are stored in a special data set or file.

warm start: A restart that allows reinitialization. Jobs that were in execution remain in the job queue; however, an IPL must be performed for each processor.

warm start with analysis: A warm start that identifies and deletes jobs which would prevent JES3 from restarting.

work station: A terminal device that may or may not be a CPU.

WTO: Write to operator.

WTR: Writer.

INDEX

Indexes to OS/VS publications are consolidated in the *OS/VS Master Index*, GC28-0602, and the *OS/VS Master Index of Logic*, GY28-0603. For additional information about any subject listed below, refer to other publications listed for the same subject in the Master Index.

ABEND dumps 6-4
access methods 5-2, 3-11
accounting information 3-15, 4-9
adapter, channel-to-channel
  definition of G-1
allocation
  data set 3-6, 4-6
    dynamic 3-6, 3-8
  device 3-6, 4-6
  of initiators 3-8
  spool data set 8-1
  volume 3-7, 4-6
alternate CPU recovery 6-1
alternate path CTC support 6-1
ASP
  definition of 62
  migration aid 6-3, 1-9
ASP (attached support processor)
  definition of G-1
ASP main processor
  definition of G-1
ASP main simulator 6-3
ASP-to-JES3 migration aid 6-3
asymmetric multiprocessing system (*see* ASP)
availability features 6-1

balancing installation workload 1-1, 1-3, 1-4, 3-8
basic configuration, JES3 1-2
basic partitioned access method (BPAM) 3-3
barrier priority 3-6
basic tightly coupled and loosely coupled configuration, JES3 1-8
batch support functions 1-9, 4-6
BCD to EBCDIC conversion 3-18
benefits to user, JES3 1-3
BSC remote work stations
  with MULTI-LEAVING support 8-6
  without MULTI-LEAVING support 8-9
BSC RJP features 3-13
BTAM (basic telecommunications access method) 5-2

CALL facility 4-6
card punches, supported by JES3 8-3, 8-4
card readers, supported by JES3 8-3, 8-4
card-to-card utility 3-18
card-to-printer utility 3-18
card-to-tape utility 3-18
catalog
  facilities 3-5
  JOBCAT 3-5
  management 5-2
  special 3-5
  STEPCAT 3-5
  system 3-5
catalogs, connected (CVOLs) 3-5
CBPRINT (control block print program) 6-3
CTC CCW trace facilities 6-5
changing job priority 4-6
channel-to-channel (CTC) adapter,
  definition of G-1
checkpoint restart support 6-1
CI (converter/interpreter)
  definition of G-1
class 1, JES3-managed 3-5
class 2, JES3-MVS jointly managed 3-5
class 3, MVS managed 3-5
CNT (console test program) 6-3
cold start 3-1
  definition of G-1
compatibilities
  JCL 4-6
compression and compaction 3-16
concepts, JES3 2-1, 3-13, 3-15
configuration 8-1
  console 8-2
  I/O device 8-6
  MCS console 8-2
  minimum 8-1
  MVS systems 1-5
  remote device 8-6, 8-9
  spool 8-1
connected catalogs (CVOLs) 3-5
console
  (*see also* operator console)
  configuration 8-2
  description of 8-2
  MLOG 6-2
  operator (*see* operator console)
  test program (CNT) 6-3
  to control system functions 4-5
console inquiry
  to determine
    space in job queue 4-5
    status of JES3 queue 4-5
    status of job 4-5
    workload 4-5
    workload backlog 4-5
CONSOLE macro 7-2
console service 3-16
  definition G-1
  errors 3-17
  functions of 3-17
  MESSAGE macro 3-17
  message processing 3-17
  multiple console support 3-17
  operator communication 3-17
console test 6-3
control block 3-4
control block print program (CBPRINT) 6-3
control card (*see* control statement)
control statement
  considerations 4-7
  processing 4-7
control units
  supported by JES3
    direct access 8-1, 8-6
    for remote devices 8-6
    magnetic tape 8-7
    printer 8-7
converter/interpreter 3-3, 3-4
  (*see also* interpreter service)
  definition of G-1
coupled configuration, JES3 1-8
coupled systems 1-1
CPU recovery, alternate 6-1
CPU-to-I/O ratio 1-5
CTC (channel-to-channel)
  definition of G-1
CVOLs (connected catalogs) 3-5

DASD (*see* direct access storage devices)
data management 3-11
  spool 3-11
data resource management 3-5
  allocation 3-6
data set
  allocation 3-6
    dynamic 3-7
    spool 1-7, 8-1
  integrity 3-5, 3-8

output, processing of 3-7
spool 8-2
DATASET control statement 4-7
data set requirements 8-7
data sets
exclusive control of 3-6
sharing 3-8
DATASET macro 7-2
DC (display selected areas of storage) 6-4
DC (dump core)
definition of G-1
DD statement
JOBCAT 3-5
STEPCAT 3-5
DDR (dynamic device reconfiguration) 3-7
definition of G-1
deadline scheduling 1-5, 3-8, 3-9
deallocation
of initiators 3-7
of data resources 3-7
DEBUG (interpreter debug program) 6-4
deletion of job 4-6
dependent job control (DJC) 1-4, 3-9, 3-10
definition of G-1
description 3-9, 3-10
predecessor jobs 3-10
successor jobs 3-10
dependent job network
complex 3-10
simple 3-9
device allocation 3-6, 3-8
device fencing 3-7
definition of G-1
device scheduling 3-7, 3-8
functions of 3-7, 3-8
purpose of 3-7, 3-8
device setup (*see* pre-execution setup)
devices
(*see also* I/O devices; remote devices)
categories 3-5
reserving 3-5
unit-record, performance of 8-3
DIE (disabled interrupt exit) 5-2
direct-access storage control units
supported by JES3 as I/O 8-1
supported by JES3 as queue device 8-3
restrictions 8-2
direct-access storage devices (DASD)
supported by JES3 as I/O 8-1
supported by JES3 as queue device 8-7
Diskette Drive, 3540 8-7
DISPDJC (display DJC tables) 6-4
DISPLAY (display job queue status) 6-4
display DJC tables (DISPDJC) 6-4
display job queue status (DISPLAY) 6-4
display selected areas of storage (DC) 6-4
DJ (dump job)
definition of G-1
DJC (*see* dependent job control)
DSI (*see* dynamic system interchange)
DSP (*see* dynamic support program)
dump job utility 3-18
dumps
ABEND 6-4
on initialization error 6-4
DYNAL function 3-6, 3-7
dynamic allocation 3-6, 3-7
definition of G-1
dynamic device reconfiguration (DDR) 3-7
definition of G-1
dynamic support program (DSP)
defining 2-1
definition of G-1
general routine 3-17
user-written 4-9
writing 4-9
dynamic system interchange (DSI) 1-7, 3-11
definition of G-1
purpose of 1-1, 1-3, 6-2
requirements for 6-2
dynamic writer 1-5, 3-12
definition of G-1

early resource release 3-7
definition of G-1
ENDDATASET control statement 4-7
ENQ/DEQ macro instructions 5-2
error recovery 3-14
error statistics 3-14
ESTAE (extended STAE)
definition of G-1
event trace facility 6-4
exclusive control of data sets 3-6
EXCP 5-2
EXCP VR 5-2
exit, user 4-8
IRB 5-1
explicit setup 3-4
definition of 3-4
external writer 3-12, 4-9
as an I/O device 8-6
as 3540 support 8-7
definition of G-1

failsoft 6-2
effect of user modifications 6-2
FCB (forms control buffer)
definition of G-1
FCT (function control table)
definition of G-1
features, categories explained 8-1
flexibility of JES3 1-1, 1-3
FORMAT AC control statement 4-7
FORMAT NJP control statement 4-7
FORMAT PR control statement 4-7
FORMAT PU control statement 4-7

gang punching 3-18
general concepts 2-1
general routines 3-17
generalized main scheduling (GMS) 3-8
definition of G-1
generation
RTP programs 7-1
system 7-1
global processor
definition of 6-1
GMS (generalized main scheduling) 3-8
definition of G-1
GTF (generalized trace facility) 6-5

HASP
definition of G-1
high watermark setup 3-4
definition of G-1
holding jobs 4-5
hot start 3-3, 6-1
definition of G-1
restart support 6-2
with analysis 3-3
hot writer 1-5, 3-12
definition of G-1
HWS (high watermark setup) G-1

IJP (internal job processing) G-4
implicit program serialization in a single task 5-1
initialization
  cold start 3-1
  control 4-1
  concepts 3-1
  definition G-1
  error dump 6-4
  hot start 3-3
  hot start with analysis 3-3
  local start 3-3
  parameters 3-2
  starter deck 3-1
  statements and their functions 4-3
  warm start 3-3
  warm start with analysis 3-3
initiators
  allocation of 3-7, 3-8
  deallocation of 3-7
input messages 3-16
input service 2-1
  control statement processing phase 3-3
  definition G-1
  description 3-3
  reader phase 3-3
inquiry by data set origin and destination 3-14
installation job processing services 4-1
installation services with JES3 services 4-1
installation workload balancing 1-1, 1-3, 1-4, 3-8
integrity, data set 3-5, 3-7
interface with RTP programs 3-14
internal reader 3-3, 3-12
  as an I/O device 8-1, 8-6
  as 3540 support 8-7
  definition G-1
interpretation of output 3-18
interpreter debug program (DEBUG) 6-4
interpreter service 3-3
  converter/interpreter 3-3
  description 3-3
  interpreter DSP 3-3
  interpreter phase 3-3, 3-4
  postscan phase 3-4
  prescan phase 3-4
  reader/interpreter 3-3, 3-4
interrupt request block (IRB) 5-1
I/O and remote configuration devices 8-2
I/O devices
  configuration 8-7
  description 8-6
  supported by JES3 8-6 - 8-8
    (*see also* control units)
    card punches 8-6 - 8-11
    card readers 8-6 - 8-11
    direct-access 8-7
    magnetic tape 8-7
    printers 8-6 - 8-11
IODEVICE macro 7-2
I/O supervisor 5-2
IOS (input/output supervisor) G-1
IOSB (input/output service block) G-1
IPL (initial program lead) G-1
IRB, interrupt request block exit routine 5-1

JCL (job control language), debugging 6-4
JCL interpretation
  (*see also* interpreter service)
  in DJC network 26
JCL test program (JCLTEST) 6-4
JCLTEST (JCL test program) 6-4
JCT (job control table) G-1
JES (job entry subsystem) G-1
JES macro 7-1
JES2, definition G-1
JES3
  abend dumps 6-4
  advantages 1-1, 1-3
  basic configuration 1-2, 8-1
  basic tightly coupled and loosely coupled configuration 1-8
  brief description 1-1
  concepts 1-1, 2-1
  considerations for installing 7-1
  definition of G-1
  features 1-4
  flexibility of 1-4
  highlights of 1-4
  initialization statements
    and their functions 4-3
  job control statements 4-7
  job management 3-1. 3-3
  job processing features 1-4
  job processing overview 2-3
  job processing services 3-2
  job queue 6-4
  migration aid 1-9
  MVS job processing services used by 5-1
  possible users 1-1, 1-3
    characteristics 1-4, 3-1
  procedure 4-2
  purpose 1-3
  RAS features 1-7
  services 3-1
  standard job flow 2-2
  support features 1-6
  system configuration 1-1, 8-1
  system configuration options 8-1
  system generation macro considerations 7-1
  system initialization 3-1, 4-1, 7-1
JES3 queue, determining status of 4-5
JES3 spool access method (JSAM) 3-11
  definition of G-2
JESTAE (JES3 extended STAE) G-2
JMR (job management record) G-2
job
  batch 3-3
  class priority 3-5, 3-8
  deletion of 4-6
  execution 3-10
  group priority 3-8, 3-9
  holding 4-5
  management 3-1
  output 3-12
  priority, changing of 3-9
  processing features 1-4
  processing overview 2-3
  processing services 3-2
  queue 4-5, 6-4
  releasing 4-5
  scheduling 3-8, 3-9
  selection 3-8
job control language (*see* JCL)
job control network
  simple dependent 3-9
  complex dependent 3-10
job control statements 4-7
job control table (JCT)
  definition of G-2
job definition 2-1, 3-3
job flow
  diagram of 2-3
  standard 2-2
  purge 2-3
job I/O rates 3-8
job management 3-3
job management record (JMR)
  definition of G-2
job queue 2-2

job queue element (JQE)
definition of G-2
job related messages to terminal of origin 3-16
job segment 3-3
job setup 3-4
job setup table test 6-5
job setup table test program (JSTTEST) 6-5
job status, determining 4-5
job summary table (JST)
definition of G-2
JOBCAT DD statement 3-4
JQE (job queue element) G-2
JSAM (JES3 spool access method), definition 3-11
JSS (job segment scheduler) G-2
JST (job setup table) 6-5
JST (job summary table) G-2
JSTTEST (job setup table test program) 6-5
JVT (job volume table) 3-4
layout, machine room 1-6, 7-2
local processor
definition of G-2
local start 3-3
locking 5-2
logical storage
definition of G-2
logical terminal support 3-14
loosely-coupled multiprocessing
definition of G-2

machine room layout 1-6, 7-2
macros
CONSOLE 7-2
DATASET 7-2
IODEVICE 7-2
JES 7-1
SCHEDULR 7-2
magnetic tape control units,
supported by JES3 8-7
magnetic tape devices,
supported by JES3 8-7
MAIN, control statement 4-7
main device scheduler (MDS)
definition G-2
device setup
explicit 3-4
high watermark 3-4
job 3-4
purpose of 3-4
SETUP DSP, control statement 2-1
volume fetch 3-5
processors supported 1-1, 8-1
main service 3-11
definition G-2
functions of 3-10, 3-11
MAIN DSP, control statement 2-1
processors supported by 3-11
main simulator 6-3
main storage, minimum size 8-1
MCS console configuration devices 8-2
MCS (multiple console support) 3-17, 8-2, G-2
MDS (*see* main device scheduler)
MESSAGE macro 3-17
message queuing for signed-off terminals 3-14
message processing
by console service 3-17
messages
input 3-16
output 3-16
migration
definition of G-2
migration aid
ASP to JES3 6-3
minimum configuration 8-1

MLOG 6-2
MSC (mass storage control) 4-2
MSS (mass storage system)
definition of G-2
MSS Table Build Program 4-2
multifunction monitor (MFM) 2-1
definition G-2
MULTI-LEAVING manager G-2
multiple console support (MCS) 3-17, 8-2
definition of
multiple copies 3-18
multiple logical unit support 3-15
multiple output copies 3-15
multiple virtual storage (MVS)
configuration 1-1
definition of G-2
multiprocessing configuration 1-1
multiprocessing system, definition G-2
MVS converter/interpreter (CI DSP) 2-1
MVS job processing services 5-1
MVS (multiple virtual storage)
configuration 1-1, 8-1
definition of G-2

NET control statement 4-7
NCP (network control program) 3-14
nonstandard job 2-1, 2-2
definition of G-2
normal job 2-2
definition of G-2

operational environment 1-6, 7-2
OPERATOR control statement 4-5
operator
commands 4-6
communication 3-16
duties 4-5
interface 4-5
role of 4-5
operator console
card reader used as 8-2, 8-7
printer used as 8-7
supported devices 8-3
optimization, system 3-9
OSE (output service element) G-2
OUTPUT command, TSO 3-16
output data sets, processing of 3-11, 3-16
output messages 3-16
output processing 3-11
(*see also* output service)
output suspension for nonprogrammable terminals 3-14
output service
definition of G-2
OUTSERV DSP 2-1
scheduler 3-12
scheduling characteristics 3-12
scheduling mode 3-12
to print control blocks 6-3
writers
description 3-12
dynamic 3-12,
hot 3-12

password protection 3-14
PAUSE control statement 4-7
PDIR (peripheral data stream record)
physical layout, machine room 7-2
planning considerations 7-1
predecessor jobs 3-4, 3-10
preexecution setup
(*see also* high watermark setup)
definition of G-2
device 3-4

test 6-3
explicit 3-4
job 3-10
primary job entry subsystem 1-1
printer control units, supported by JES3 8-3 - 8-11
printers, supported by JES3 8-3 - 8-11
priority
changing 3-6
hierarchy of 3-6
job class 3-5
job group 3-6
processor 3-6
PRTY parameter 3-8
priority aging 1-5, 3-6
procedure library (PROCLIB)
features 3-4
updating 3-4
PROCESS control statement 4-7
processor, priority of 3-6
processors, maximum number of 1-1
processors supported 1-1, 3-11, 7-1, 8-1
PROCLIB (procedure library)
features 1-6, 3-4
updating 3-4
programs
dynamic support (DSP) 1-6, 2-1, 3-3, 4-7, 4-9
definition
service aids (*see* service aids)
PRTY parameter 3-8
punches, card, supported by JES3 8-6, 8-7
purge 2-2, 3-13
job cleanup 3-13
PURGE DSP 2-3, 3-13
queue devices 8-1
restrictions 8-1
queue dump facility 6-4

RAS features 1-7
RAS (reliability, availability, serviceability) 1-7, 6-1
reader 3-3, 3-12
internal 3-3
as an I/O device 8-6
as 3540 support 8-7
phase of input service 3-3
reader/interpreter 3-3
definition G-2
readers, card, supported by JES3 8-3
reconfiguration, dynamic device (DDR) 1-6, 3-7, 4-6
recovery procedures
alternate CPU recovery 6-1
alternate path CTC support 6-1
checkpoint restart 7-3, 6-1, 6-2
dynamic system interchange (DSI) 1-3, 1-7, 3-11, 6-2
failsoft 6-2
hot start 6-2
RJP recovery 6-1
service aids 6-1
spool I/O errors 6-2
releasing
jobs 3-7, 4-5, 4-6
resources 3-7
reliability, availability, serviceability (RAS) 6-1
reliability features 6-1
remote console support 3-13, 3-14
remote devices
configuration 8-6
control units 8-6
described 8-6
features 8-6
supported by JES3 8-7
remote job processing (RJP) 3-13
capabilities 6-1
definition of G-2
description 3-13
error recovery 3-14, 6-1
supported functions 3-13
supported terminals 8-6
terminal features 8-7, 8-8, 8-10, 8-12
remote 3211 printer FCB loading 3-14
remote printer setup 3-15
remote terminal access method (RTAM) 3-13
definition of G-2
remote terminal processor (RTP)
definition G-2
programs 3-14, 7-1
support 8-6
remote terminal processor program (RTP) 3-14
definition G-2
remote workstations
non-programmable 8-8, 8-10
programmable 8-6
features 8-8
systems 8-8
terminals 8-8
resident parameter table (RESPARAM)
definition of G-2
resource management 3-5
features 3-5
main device scheduler 3-5
pre-execution setup 3-4
resource scheduling and management 1-4
restart 3-3, 4-6
checkpoint 6-1
job processing 4-6
RI (reader/interpreter)
definition of G-2
RJP (*see* remote job processing)
RJP (remote job processing)
definition of G-2
RJP line snap facility 6-5
RMT (remote terminal processor program)
definition of G-2
RTAM (remote terminal access method) 3-13, G-2, 5-2
RTP (*see* remote terminal processor)

SCBs (scheduler control blocks)
scheduler 3-12
scheduler work area (SWA) 3-14
scheduling, deadline 3-8, 3-9
scheduling features 3-8
SCHEDULR macro 7-2
SCP (system control program) 3-5
SE (scheduler element)
definition of G-2
selectable output data recovery levels 3-15
selectable parameters 3-15
sequencing, gang punching, and field arrangement 3-18
sequencing of the reproduced cards 3-18
SDLC (synchronous data link control) 3-15
service aids 6-3
ABEND dumps 6-4
ASP main simulator 6-3
ASP to JES3 migration 6-3
console test (CNT) 6-3
control block print (CBPRINT) 6-3
display areas of storage (DC) 6-4
display DJC tables (DISPDJC) 6-4
display job queue status (DISPLAY) 6-4
dump on initialization error 6-5
event trace facility 6-4
interpreter debug (DEBUG) 6-4
JCL test (JCLTEST) 6-4
JST test 6-5
RJP line snap 6-5

SNA RJP exit routines 5-1
SNA RJP VTAM 6-5
serviceability features 6-1
setup
(*see also* pre-execution setup)
definition G-2
early resource release 3-7
explicit 3-4
high watermark 3-4
job 3-4
test 6-5
shared spool 1-7
advantages 1-7, 3-11
concept 1-7, 3-11
sharing
data sets 3-6
devices 3-6
volumes 3-6
SMF (*see* system management facilities)
SNA remote work stations 8-8
SNA RJP features 3-15
SNA RJP work stations 8-12
SNA (system network architecture) G-2
spin data set
definition of G-2
SRB (service request block) 5-1
spool, shared 1-7, 3-11
spool configuration 8-1
spool data management 3-11
spool data set allocation 8-1
spool I/O errors, recovery from 6-2
SSI (subsystem interface)
definition of G-2
SSI (subsystem interface) routines 2-2
STAE (specify task abnormal exit) G-2
Standard job flow 2-2
starter deck, initialization 3-1
status of JES3 job queue 6-4
STEPCAT DD statement 3-5
storage, main, minimum size 8-1
string switch facility 8-7
subsystem interface (SSI), definition G-2
subsystem interface (SSI) routines 2-2
successor jobs 3-10
supervisor services 5-1
support features 1-6
support functions
defined 2-1
examples 2-3
support of ASCII 3-15
SVC (supervisor call) G-3
SVF (set vertical format) 3-15
SVS (single vertual storage) 1-6, 7-1
system configuration 1-1
system configuration options 8-1
system generation 7-1
macro considerations 7-1
CONSOLE macro 7-2
DATASET macro 7-2
IODEVICE macro 7-2
JES macro 7-1
SCHEDULR macro 7-2
system initialization 3-1
system management facilities (SMF)
described 4-9
support of 4-9
types of records 4-9
system optimization 3-8
system performance 3-9
system resource manager 5-3
System/370 models supported 8-1

tape dump utility 3-18
tape label utility 3-19
tape-to-card utility 3-19
tape-to-printer utility 3-19
tape-to-tape utility 3-19
TCB (task control block) 5-1
terminals, supported 8-3
time sharing option (TSO)
support of 3-16
users job facilities for 3-16
TSO (*see* time sharing option)

UCS (universal character set) 4-5
USAM (user spool access method) 3-11
definition G-3
user exit 4-8
user spool access method (USAM), 3-11
definition G-3
users of JES3, 1-1
utility programs 3-18
card-to-card 3-18
card-to-printer 3-18
card-to-tape 3-18
dump job 3-18
dynamic support 3-18
tape dump 3-18
tape label 3-19
tape-to-card 3-19
tape-to-printer 3-19
tape-to-tape 3-19

volume fetch 3-5, 3-6
volume mounting and verification 3-6
VTAM 5-2, 5-3, G-3

warm start 3-1
definition of G-3
with analysis 3-3
workload
balancing 1-3
determining 1-3
workstation
(*see also* remote workstations)
definition G-3
writer
dynamic 3-12
definition G-3
external 3-12
as an I/O device 8-6
as 3540 support 8-7
hot 3-12
WTO (write to operator)
definition of G-3
WTR (writer)
definition of G-3

2770/3780 blank compression 3-14
3540 Diskette Drive 8-7
3850 mass storage system (MSS)
definition of G-2

Introduction to JES3

Order No. GC28-0607-2

READER'S COMMENT FORM

This manual is part of a library that serves as a reference source for systems analysts, programmers, and operators of IBM systems. Your views about this publication may help improve its usefulness; this form will be sent to the author's department for appropriate action. Comments may be written in your own language; use of English is not required. You will help us by attaching a copy of the pages to which your comments pertain.

IBM shall have the nonexclusive right, in its discretion, to use and distribute all submitted information, in any form, for any and all purposes, without obligation of any kind to the submitter. Your interest is appreciated.

Note: *Copies of IBM publications are not stocked at the location to which this form is addressed. Please direct any requests for copies of publications, or for assistance in using your IBM system, to your IBM representative or to the IBM branch office serving your locality.*

Possible topics for comment are:

Clarity Accuracy Completeness Organization Index Figures Examples Legibility

Note: Staples can cause problems with automated mail sorting equipment. Please use pressure sensitive or other gummed tape to seal this form.

Cut or Fold Along Line

Selectable units installed on your system after February 1976: _____

_____

_____

What is your occupation? _____

Number of latest Technical Newsletter or Supplement associated with this publication: _____

If you would like a reply, please print: _____

Your Name _____

Company Name _____

Department _____

Street Address _____

City _____ State _____ Zip Code _____

Thank you for your cooperation. No postage stamp necessary if mailed in the U.S.A. (Elsewhere, an IBM office or representative will be happy to forward your comments.)

Reader's Comment Form

Cut or Fold Along Line

Fold and tape | Please Do Not Staple | Fold and tape

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 40 ARMONK, N.Y.

POSTAGE WILL BE PAID BY ADDRESSEE:

International Business Machines Corporation
Department 4F7
18100 Frederick Pike
Gaithersburg, Maryland 20760

Fold and tape | Please Do Not Staple | Fold and tape

IBM®

International Business Machines Corporation
Data Processing Division
1133 Westchester Avenue, White Plains, N.Y. 10604

IBM World Trade Americas/Far East Corporation
Town of Mount Pleasant, Route 9, North Tarrytown, N.Y., U.S.A. 10591

IBM World Trade Europe/Middle East/Africa Corporation
360 Hamilton Avenue, White Plains, N.Y., U.S.A. 10601

Introduction to JES3 (S370-34) Printed in U.S.A. GC28-0607-2

GC28-0607-2

Introduction to JES3 (S370-34) Printed in U.S.A. GC28-0607-2

International Business Machines Corporation
Data Processing Division
1133 Westchester Avenue, White Plains, N.Y. 10604

IBM World Trade Americas/Far East Corporation
Town of Mount Pleasant, Route 9, North Tarrytown, N.Y., U.S.A. 10591

IBM World Trade Europe/Middle East/Africa Corporation
360 Hamilton Avenue, White Plains, N.Y., U.S.A. 10601